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Second Annual Meeting, Champaign, Ill., Nov. 11–13, 1890. (The same officers had charge of this meeting.)

Third Annual Meeting, Washington, D. C., Aug. 17–18, 1891. President, James Fletcher; First Vice-President, F. H. Snow; Second Vice-President, Herbert Osborn; Secretary, L. O. Howard.

Fourth Annual Meeting, Rochester, N. Y., Aug. 15–16, 1892. President, J. A. Lintner; First Vice-President, S. A. Forbes; Second Vice-President, J. H. Comstock; Secretary, F. M. Webster.

Fifth Annual Meeting, Madison, Wis., Aug. 14–16, 1893. President, S. A. Forbes; First Vice-President, C. J. S. Bethune; Second Vice-President, John B. Smith; Secretary, H. Garman.

Sixth Annual Meeting, Brooklyn, N. Y., Aug. 14–15, 1894. President, L. O. Howard; First Vice-President, John B. Smith; Second Vice-President, F. L. Harvey; Secretary, C. P. Gillette.

Seventh Annual Meeting, Springfield, Mass., Aug. 27–28, 1895. President, John B. Smith; First Vice-President, C. H. Fernald; Secretary, C. L. Marlatt.

Eighth Annual Meeting, Buffalo, N. Y., Aug. 21–22, 1896. President, C. H. Fernald; First Vice-President, F. M. Webster; Second Vice-President, Herbert Osborn; Secretary, C. L. Marlatt.

Ninth Annual Meeting, Detroit, Mich., Aug. 12–13, 1897. President, F. M. Webster; First Vice-President, Herbert Osborn; Second Vice-President, Lawrence Bruner; Secretary, C. L. Marlatt.

Tenth Annual Meeting, Boston, Mass., Aug. 19–20, 1898. President, Herbert Osborn; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, C. L. Marlatt.

Eleventh Annual Meeting, Columbus, Ohio, Aug. 18–19, 1899. President, C. L. Marlatt; First Vice-President, Lawrence Bruner; Second Vice-President, C. P. Gillette; Secretary, A. H. Kirkland.

Twelfth Annual Meeting, New York, N. Y., June 22–23, 1900. President, Lawrence Bruner; First Vice-President, C. P. Gillette; Second Vice-President, E. H. Forbush; Secretary, A. H. Kirkland.

Thirteenth Annual Meeting, Denver, Colo., Aug. 23–24, 1901. President, C. P. Gillette; First Vice-President, A. D. Hopkins; Second Vice-President, E. P. Felt; Secretary, A. L. Quaintance.

Fourteenth Annual Meeting, Pittsburgh, Pa., June 27–28, 1902. President, A. D. Hopkins; First Vice-President, E. P. Felt; Second Vice-President, T. D. A. Cockerell; Secretary, A. L. Quaintance.

Fifteenth Annual Meeting, Washington, D. C., Dec. 26–27, 1902. President, E. P. Felt; First Vice-President, W. H. Ashmead; Second Vice-President, Lawrence Bruner; Secretary, A. L. Quaintance.

Sixteenth Annual Meeting, St. Louis, Mo., Dec. 29–31, 1903. President, M. V. Slingerland; First Vice-President, C. M. Weed; Second Vice-President, Henry Skinner; Secretary, A. F. Burgess.

Seventeenth Annual Meeting, Philadelphia, Pa., Dec. 29–30, 1904. President, A. L. Quaintance; First Vice-President, A. F. Burgess; Second Vice-President, Mary E. Murtfeldt; Secretary, H. E. Summers.

Eighteenth Annual Meeting, New Orleans, La., Jan. 1–4, 1906. President, H. Garman; First Vice-President, E. D. Sanderson; Second Vice-President, F. L. Washburn; Secretary, H. E. Summers.

Nineteenth Annual Meeting, New York, N. Y., Dec. 28–29, 1906. President, A. H. Kirkland; First Vice-President, W. E. Britton; Second Vice-President, H. A. Morgan; Secretary, A. F. Burgess.

Twentieth Annual Meeting, Chicago, Ill., Dec. 27–28, 1907. President, H. A. Morgan; First Vice-President, H. E. Summers; Second Vice-President, W. D. Hunter; Secretary, A. F. Burgess.

Twenty-first Annual Meeting, Baltimore, Md., Dec. 28–29, 1908. President, S. A. Forbes; First Vice-President, W. E. Britton; Second Vice-President, E. D. Ball; Secretary, A. F. Burgess.

Twenty-second Annual Meeting, Boston, Mass., Dec. 28–29, 1909. President, W. E. Britton; First Vice-President, E. D. Ball; Second Vice-President, H. E. Summers; Secretary, A. F. Burgess.

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Twenty-fourth Annual Meeting, Washington, D. C., Dec. 27–29, 1911. President, F. L. Washburn; First Vice-President, E. D. Ball; Second Vice-President, R. H. Pettit; Secretary, A. F. Burgess.

Twenty-fifth Annual Meeting, Cleveland, Ohio, Jan. 1–3, 1913. President, W. D. Hunter; First Vice-President, T. J. Headlee; Second Vice-President, R. A. Cooley; Secretary, A. F. Burgess.

Twenty-sixth Annual Meeting, Atlanta, Ga., Dec. 31, 1913–Jan. 2, 1914. President, P. J. Parrott; First Vice-President, E. L. Worsham; Second Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

Twenty-seventh Annual Meeting, Philadelphia, Pa., Dec. 28–31, 1914. President, H. T. Fernald; First Vice-President, Glenn W. Herrick; Second Vice-President, W. E. Britton; Third Vice-President, Wilmon Newell; Secretary, A. F. Burgess.

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Young, D. B., State Museum, Albany, N. Y.
Young, M. T., Tallulah, La.

FOREIGN MEMBERS

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Proceedings of the Thirty-Second Annual Meeting of the American Association of Economic Entomologists

The thirty-second annual meeting of the American Association of Economic Entomologists was held in the Girls Gymnasium, Soldan High School, St. Louis, Mo., December 31, 1919, and January 1 and 2, 1920.

The meeting was called to order at 10.20 a. m., December 31, by President W. C. O'Kane, and the annual reports and preliminary business was transacted during that session. In the afternoon of the same day, a program of papers was presented and the annual address of the President was delivered at 2.30 p. m. On the same evening, the Section on Apiculture held its meeting when papers were presented and three reels of moving picture films were exhibited. The Association resumed its sessions on Thursday morning, January 1, and in the afternoon the Section on Horticultural Inspection presented its program.

On Thursday evening a dinner was held at the Missouri Athletic Club, at which over eighty entomologists were present. At the close of the dinner President O'Kane introduced Dr. Howard who presided in a very agreeable way. He read a letter that he had recently received from Dr. Josef Jablonowski, from Budapest, which was a pleasant surprise to all the members present. He also introduced past presidents Forbes, Osborn, Marlatt, Felt, Britton, Parrott and Ball, who responded with appropriate remarks.

Mr. Arthur Gibson, the only entomologist present from Canada, was called on and made an appropriate response.

The occasion throughout was a very pleasant one for all the members.

A. P.

The Association program was continued on Friday morning, January 2, and in the afternoon papers were presented and the business session was held.

The business proceedings form Part I of this report and the addresses, papers, and discussions Part II.

The proceedings of the Section on Apiculture and on Horticultural Inspection will be prepared and published by the Sectional Secretaries as part of this report.

PART I. BUSINESS PROCEEDINGS

The meeting was called to order by President W. C. O'Kane, at 10.20 a. m., Wednesday, December 31, 1919. About 150 members and visitors attended the sessions. The following were present:

C. N. Ainslie, Sioux City, Iowa.
George G. Ainslie, Knoxville, Tenn.
R. H. Allen, Boston, Mass.
William J. Baerg, Fayetteville, Ark.
E. D. Ball, Ames, Iowa.
G. G. Becker, Fayetteville, Ark.
G. M. Bentley, Knoxville, Tenn.
S. W. Bilsing, College Station, Texas.
R. A. Blanchard, Webster Groves, Mo.
W. E. Britton, New Haven, Conn.
A. F. Burgess, Melrose Highlands, Mass.
S. C. Chandler, Carbondale, Ill.
R. N. Chapman, Minneapolis, Minn.
LeRoy Childs, Hood River, Ore.
T. D. A. Cockerell, Boulder, Colo.
Mel. T. Cook, New Brunswick, N. J.
E. C. Cotton, Columbus, Ohio.
J. J. Davis, Riverton, N. J.
George A. Dean, Manhattan, Kan.
M. L. Dean, Olympia, Wash.
O. D. Deputy, Laredo, Texas.
E. H. Dusham, State College, Pa.
E. P. Felt, Albany, N. Y.
H. L. Flackler, Knoxville, Tenn.
W. P. Flint, Urbana, Ill.
S. A. Forbes, Urbana, Ill.
S. B. Fracker, Madison, Wis.
B. B. Fulton, Corvallis, Ore.
Arthur Gibson, Ottawa, Canada.
P. A. Glenn, Urbana, Ill.
James C. Goodwin, Gainesville, Fla.
H. A. Gossard, Wooster, Ohio.
J. E. Graf, Puente, Cal.
Samuel A. Graham, St. Paul, Minn.
D. W. Grimes, Agricultural College, Miss.
R. W. Harned, Agricultural College, Miss.
Leonard Haseman, Columbia, Mo.
W. P. Hayes, Manhattan, Kan.
T. J. Headlee, New Brunswick, N. J.
Glenn W. Herrick, Ithaca, N. Y.
E. J. Hoddy, Knoxville, Tenn.
H. E. Hodgkiss, State College, Pa.
W. A. Hoffman, Washington, D. C.
W. E. Hoffmann, Lawrence, Kan.
W. J. Holland, Pittsburgh, Pa.
W. O. Hollister, Kent, Ohio.
J. L. Horsfall, Dubuque, Iowa.
J. S. Houser, Wooster, Ohio.
L. O. Howard, Washington, D. C.
H. B. Hungerford, Lawrence, Kan.
H. G. Ingerson, Columbus, Ohio.
Dwight Isely, Washington, D. C.
V. L. Kellogg, Washington, D. C.
E. G. Kelly, Manhattan, Kan.
C. H. Kennedy, Columbus, Ohio.
H. H. Kimball, Agricultural College, Miss.
J. L. King, Harrisburg, Pa.
E. J. Kraus, Madison, Wis.
J. M. Langston, Agricultural College, Miss.
W. H. Larrimer, West Lafayette, Ind.
F. H. Lathrop, Corvallis, Ore.
R. W. Leiby, Raleigh, N. C.
R. N. Lobdell, Agricultural College, Miss.
Stewart Lockwood, Agricultural College, N. D.
C. L. Marlatt, Washington, D. C.
J. W. McColloch, Manhattan, Kan.

C. L. Metcalf, Columbus, Ohio.
Z. P. Metcalf, West Raleigh, N. C.
J. H. Montgomery, Gainesville, Fla.
Edna Mosher, Albuquerque, N. M.
Henry Ness, Ames, Iowa.
Wilmon Newell, Gainesville, Fla.
F. M. O'Byrne, Gainesville, Fla.
W. C. O'Kane, Durham, N. H.
Herbert Osborn, Columbus, Ohio.
Raymond C. Osburn, Columbus, Ohio.
F. B. Paddock, Ames, Iowa.
H. R. Painter, Webster Groves, Mo.
J. R. Parker, Bozeman, Mont.
R. R. Parker, Bozeman, Mont.
P. J. Parrott, Geneva, N. Y.
Edith M. Patch, Orono, Me.
L. M. Peairs, Morgantown, W. Va.
F. C. Pellett, Hamilton, Ill.
Alvah Peterson, New Brunswick, N. J.
W. D. Pierce, Denver, Colo.
W. A. Price, Lafayette, Ind.
George H. Rea, Ithaca, N. Y.
H. J. Reinhard, College Station, Texas.
W. A. Riley, St. Paul, Minn.
J. M. Robinson, Auburn, Ala.
A. G. Ruggles, St. Paul, Minn.
W. E. Rumsey, Morgantown, W. Va.
V. I. Safro, Louisville, Ky.
J. G. Sanders, Harrisburg, Pa.
E. R. Sasscer, Washington, D. C.
A. F. Satterthwait, Webster Groves, Mo.
W. J. Schoene, Blacksburg, Va.
E. E. Scholl, Austin, Texas.
V. E. Shelford, Urbana, Ill.
Franklin Sherman, Jr., Raleigh, N. C.
F. L. Simanton, Benton Harbor, Mich.
O. I. Snapp, Agricultural College, Miss.
E. W. Stafford, Agricultural College, Miss.
Frank Stirling, Gainesville, Fla.
K. C. Sullivan, Columbia, Mo.
M. H. Swenk, Lincoln, Neb.
M. C. Tanquary, Manhattan, Kan.
L. R. Taft, East Lansing, Mich.
F. L. Thomas, Auburn, Ala.
James Troop, Lafayette, Ind.
W. R. Walton, Washington, D. C.
H. R. Watts, Knoxville, Tenn.
R. L. Webster, Ithaca, N. Y.
C. A. Weigel, Washington, D. C.
R. D. Whitmarsh, Milwaukee, Wis.

PRESIDENT W. C. O'KANE: The meeting will please come to order. We will listen to the Secretary's report.

SECRETARY A. F. BURGESS: Before reading the report, I would like to make a short statement which may be of interest to some of the members.

Sixteen years ago this Association met at St. Louis. This was the first year that the speaker acted as your Secretary. At that meeting, the records show that there were on the rolls 91 active, 43 associate and 41 foreign members, or a total membership of 175. The present membership is 566, which indicates how we have grown. At the St. Louis meeting sixteen years ago, 29 members were present. Today over 100 have registered.

REPORT OF THE SECRETARY

At the time of the Baltimore meeting, the total membership of the Association was 553; active 164, associate 340, and foreign 48. At that meeting, one active and four associate members resigned, and 53 were transferred from the associate to the active roll. During the year, 17 associate members have been dropped and one associate and one foreign member have died. Thirty-seven associate members were elected at the Baltimore meeting and one was reinstated. The present membership totals 566, and includes 216 active, 303 associate, and 47 foreign. The net gain for the year has been 13 members.

May 21, 1916, Prof. A. Porchinski, Minister of Agriculture, Petrograd, Russia,

died. He has been a foreign member of this Association for many years, but the news of his death was received recently.

On September 30, 1919, Patricio P. Cardin, an associate member of this Association, died as the result of an operation for kidney trouble. He was a graduate of the Massachusetts Agricultural College, and had been carrying on entomological work in Cuba for a number of years. His early death was deeply regretted by all those who were acquainted with him and the work which he was carrying on.

The Pacific Slope Branch of this Association held its fourth annual meeting at Mission Inn, Riverside, Cal., May 28, 1919. Forty-seven members and visitors were present. There was the largest attendance at this meeting of any that has been held by this branch. An excellent program was presented which is printed in full in the August number of the JOURNAL.

During the past year a number of copies of Banks index to the literature of Economic Entomology have been sold. The expenses in connection with this project have been very light, so that it has been possible to return $200 to the Association fund. At the present time the index account owes the Association fund $100, and if sales continue throughout the coming year, it should be possible to pay back this amount.

The honor roll of the members of the Association who served in the Great War was published in the February issue of the JOURNAL. Since that time the Secretary has been advised of two members whose names did not appear on that roll, namely: Albert Hartzell, who served in the United States Army, and George H. Corbett, who served as a lieutenant in the British Army. It is regretted that the information was not at hand so that these names could have been placed on the original roll when it was published.

THE JOURNAL OF ECONOMIC ENTOMOLOGY

At the Baltimore meeting, a special committee was appointed to consider the financial situation in connection with the JOURNAL. This committee reported that the JOURNAL should be kept at approximately the same size as during the previous year; that authority be given to use $500 from the general funds of the Association, if this amount was necessary, and to secure contributions amounting to $100, the same to be repaid in subscriptions to the JOURNAL in future years. These recommendations of the committee were adopted by the Association and it was voted that the price of the JOURNAL, beginning with the year 1920, be fixed by the executive committee of the Association. During the meeting, $160 was subscribed by members for the JOURNAL fund. Of this amount, $60 was paid in during the year, and advance subscriptions have been credited to each subscriber. The executive committee of the Association considered the financial condition of the JOURNAL early in the year, and voted to increase the price $1.00 to all subscribers, beginning January 1, 1920.

During the year 1918, 494 pages were published in the JOURNAL; in 1919, 478 pages were printed. The subscription list has increased materially during the past year, and an unusually large number of back numbers have been sold. This is principally due to the fact than an increase of $1.00 a volume on back numbers will go into effect on January 1, and because a considerable number of foreign subscribers have purchased back numbers.

During the year, the Secretary has transferred from the Association funds to the JOURNAL fund, $250, and with the amount paid in by members who contributed at the last annual meeting, the funds have been sufficient to carry the JOURNAL through the year with a comfortable balance. The future of the JOURNAL would be assured and it would probably now be on a self-supporting basis were it not for the fact that the cost of printing has just been advanced 25 per cent. This is our largest single item of expenditure and an advance at this rate on our present subscription list means an increase in cost of production of at least 75 cents for each subscriber.

Owing to this condition and to the probability that further increases in cost of producing the JOURNAL may be made at any time without notice, it is recommended that authority be given to increase the price of the JOURNAL on or before July 1, 1920, if conditions during the first half of the coming year appear to make this course necessary. Any increase in rate during the year 1920, would, of course, not be effective until January 1, 1921.

ASSOCIATION STATEMENT

Balance in Treasury, December 10, 1918		$605.17
By amount received from dues, 1919		616.42
By amount received from interest in Malden National Bank		10.58
By amount received from interest, Melrose Savings Bank		14.60
By amount received from interest $100 Liberty Bond		4.25
By amount received from Index fund		200.00
Paid stenographic report of 1918 meeting	$113.78	
Buttons, 1918 meeting	11.14	
Postage	58.74	
Printing programs, etc.	81.25	
Telegraph and express	7.28	
Expenses of membership committee	3.90	
Expenses of Pacific Coast Branch	22.45	
Transfer to JOURNAL account	250.00	
Clerical work, Secretary's office	49.00	
One-half salary of Secretary	50.00	
	$647.54	
Balance, December 8, 1919	803.48	
	$1,451.02	$1,451.02
Balance deposited as follows:		
Melrose Savings Bank	$172.02	
Malden National Bank	631.46	

JOURNAL STATEMENT

Balance in Treasury, December 10, 1918		$94.91
By amount received from subscriptions, advertising, etc.		2,413.46
By amount received from Association fund		250.00
By amount received from interest on bank deposit		5.07
By amount received from members, advanced payments		60.00
Paid for postage	$55.53	
Paid for insurance	18.70	
Paid for printing	1,828.52	
Paid for half-tones	232.64	
Return on subscriptions	19.73	
Salary, Editor	100.00	
Clerical work, Editor's office	75.00	
One-half salary of Secretary	50.00	
Clerical work, Secretary's office	50.00	
	$2,430.12	
Balance, December 8, 1919	393.32	
	$2,823.44	$2,823.44
Balance deposited in Malden, Mass., National Bank	$393.32	

INDEX STATEMENT

Balance in Treasury, December 10, 1918		$46.92
By amount received from sales to December 1, 1919		223.35
Paid for cartons	$19.85	
Postage	6.00	
Insurance	18.70	
Transfer to Association fund	200.00	
	$244.55	
Balance, December 8, 1919	25.72	
	$270.27	$270.27
Balance deposited in Malden, Mass., National Bank	$25.72	

SUMMARY

Balance on Index Account	$25.72
Balance on JOURNAL Account	393.32
Balance on Association Account	803.48
One 4¼ per cent Liberty Bond	100.00
	$1,322.52

Respectfully submitted,

A. F. BURGESS, *Secretary.*

On motion the report of the Secretary was accepted and the financial part referred to the auditing committee.

PRESIDENT W. C. O'KANE: I will now read the report of the Executive Committee.

REPORT OF THE EXECUTIVE COMMITTEE

EUROPEAN CORN BORER

Members of the Executive Committee have been actively interested in furthering efforts to secure from Congress adequate funds with which to prosecute the campaign against the European Corn Borer.

In this work your President felt it his duty to assist in whatever way lay in his power. With that intent he visited Washington several times in the early part of this year, in order to help set before Congressional committees the judgment of our Association as to the urgent need for adequate funds, and to further the efforts of the Bureau of Entomology to secure such funds. In carrying out this plan conferences were held with officers of the Bureau of Entomology and with members of the Senate and the House. A special meeting of the Senate Committee on Agriculture was arranged by means of which the resolution adopted by this Association at its last meeting, together with other information, was brought officially before the Committee and placed in the records. Through the joint efforts of your officers, with the American Plant Pest Committee, officers of the Bureau of Entomology and the Secretary of Agriculture, additional appropriations were set under way, but were lost in the filibuster which ended the Congress that adjourned last spring.

NATIONAL RESEARCH COUNCIL

In February a communication was received from the National Research Council

asking the nomination of one of our members to represent this Association as a member of the Council in the Division of Biology and Agriculture.

With the approval of the Executive Committee the President nominated Mr. P. J. Parrott, as the Association's representative. Mr. Parrott accepted the appointment and has instituted measures of great interest and value to the profession.

It is recommended that the Association provide for regular and permanent representation on the Council by electing a member to serve as its representative for a term of three years, election for such term to take place at this meeting in the regular order, after nomination by the nominating committee.

Salaries in Entomology

The fact that most professional men whose income is in the form of a salary are hard pressed by the increased cost of living is too well recognized to need proof. The condition prevails through practically all salaried positions except those of a commercial nature.

Teachers and experimenters have probably suffered more than any other class through this unfortunate state of affairs. This is for several reasons. Their salaries were relatively low ten years ago, before the rise in costs began. They have necessary living and professional standards to maintain. Their work is of such nature that an outside income of a substantial character is not usually possible.

The actual increase in cost of living in the past five years cannot be set down in definite and final figures. This is in part because commodity prices vary in different parts of the country, in part for the reason that the proportion to which a given article enters into the living expenses of a family varies. The rise in price of these several different articles has been in different degree.

In a prior study that was made by your President in another capacity a year ago, a comparison was drawn between college salaries in general in 1898 and those of 1918; and a further comparison between commodity prices in those two periods. In arriving at living costs, information was asked of various economic authorities. The average of their statements indicated that the dollar which was worth 100 cents in 1898 was worth only 45 cents in 1918. The figures as to salary were secured by a request sent to college authorities. The result of this indicated that the average, reasonably competent head of department received approximately $2,000 in 1898 and approximately $3,000 in 1918. In other words in the course of that twenty-year period, living costs had increased considerably over 100 per cent while salaries had risen 50 per cent.

Taking a more recent period, for comparison and setting up on one hand the living costs of five or ten years ago and on the other hand those of the current year, it seems reasonable to state that for the salaried professional man the cost of living in that time has doubled.

In a discussion of this subject, recently printed and distributed by Harvard University in the course of its campaign for increased endowment, the following statements occur:

"The fact is that this ideal toward which Harvard has striven during nearly three hundred years is less likely now of attainment than ever before. Because of underpayment of the teaching staff, Harvard is threatened with the loss of some of her brilliant men and with increasing difficulty in replacing them with teachers of equal calibre.

"When a man becomes a teacher, he does not look forward to the accumulation of a fortune. His dominant motives are love of teaching and devotion to the aims of scholarship. He must, however, have a material basis for the realization of his ideal, namely, a competence sufficient to insure a living conforming to the modest

standards of academic life, the means of enjoying family life, and a reasonable provision for the assistants and the equipment necessary for the economic use of his time and energy."

The scale of salary prevailing in the Faculty of Arts and Science at Harvard University is given as follows:

Instructors, $1,200 to $1,500; assistant professors $2,500 to $3,000; professors $4,000 to $5,500.

The booklet issued by the University further says:

"On this salary basis teachers at Harvard with the highest scholarly attainments and with unusual teaching ability cannot afford to remain today unless they have private incomes or earn money by outside work.

"It is safe to say that 90 per cent of the teachers at Harvard cannot live, without personal sacrifice, on the salaries paid them for teaching.

"Harvard may expect loyalty from her teachers, but she should not expect economic martyrdom.

"The young scholars, who should be the professors of tomorrow, stand between two alternatives. One is three years of additional labor and a considerable investment before they can become Doctors of Philosophy and thus qualify as university teachers. The other is the world outside the college. . . . They see at the end of seven years of study $1,200 a year, slow advancement and a station in the economic scale lower than waiters, policemen, chauffeurs or street cleaners."

The salary scale now prevailing at Harvard University, which is the subject of the above statements, is materially larger than that in effect in a large proportion of our colleges and universities or in our state or federal bureaus. Living costs in Cambridge, Mass., are approximately the same as those in some other localities and are larger than costs in the middle west and the far west. The condition of teachers and experimenters, as described in the Harvard publication, obviously applies in general elsewhere. The following letter is one among several received by your Executive Committee along with replies to their questionnaire:

"Since living costs have risen and neither state or federal service can or will pay enough to cover even a small part of this increased cost, there seems no other road open but to enter the commercial field. This presumes that one must be proficient in some other line or profession. But when a man can step into another line of work, at a salary larger than he can get after twelve years of successful work in his chosen line, it's time to wake up."

The present condition is, no doubt, as fully recognized by administrative officers as by the teachers and experimenters themselves. Such recognition is the basis of the efforts to raise large endowment funds now in progress in several of our universities. Unfortunately, it is not likely that such efforts can be duplicated in similar degree throughout all institutions that employ scientific men. In addition there are large numbers who are employed by various governmental and state departments.

The profession of entomology is sharing in the salary problem. The inevitable effect is to injure the profession itself in serious degree and to darken the horizon for the men who are engaged in it. Young men of promise are attracted to other lines of work. Capable men now in the profession leave it. Large numbers who have already spent a part of their lives in the profession find their energies scattered and their efficiency diminished. Furthermore, as the months passed during this current year commodity prices have increased instead of decreasing and the difficulty has grown increasingly acute.

In this state of affairs your Executive Committee desired to perform whatever service might helpfully and constructively assist toward a betterment of conditions for entomologists. With that intent and with the assistance of a special committee

a questionnaire was sent, in August, to all members of the Association. The purpose of this was to disclose accurately the condition of salaries throughout the profession and to solicit the judgment of members as to the amount of increases that should take place.

The questionnaires were returned by 260 men engaged in the profession of entomology. Geographically the replies represent forty states, the District of Columbia, the Dominion of Canada, Mexico, the Canal Zone and the Territory of Hawaii.

All replies were divided into three classes, as follows:

Class I. Men who are at the head of a department or important division of work. This includes department heads in colleges and experiment stations, state entomologists, chief state inspectors, and men in charge of divisions in the Bureau of Entomology and in the Dominion Service.

Class II. Men not officially the head of a department but responsible for an important and well-defined section of work. This includes associates in our larger departments. Under this is included, also, men employed by the Federal Bureau and in charge of sub-stations.

Class III. Men who are doing the work of assistants.

It is appreciated that the above divisions cannot be considered as definite lines of demarcation. Many assistants carry a large measure of responsibility. In each of the three classes the actual amount of responsibility and general nature of the work vary with different individuals.

Assuming the above classification and omitting a few replies from men who have lately changed their position or who could not be classified for other reasons, there are found to be sixty-seven replies in Class I, sixty-six in Class II and one hundred and fifteen in Class III.

Class I

Of the 67 men in this class 34 are doing teaching as a part or all of their work; 35 have experiment station duties; 32 are in state departments in whole or in part; 22 are in federal employ.

The average total compensation in this class, including house rent or other additional compensation prevailing in a few instances, is $3,014.91.

The average annual vacation enjoyed by men in Class I is 27.6 days; 63 per cent of these men are allowed time in which to attend professional meetings, expenses being paid in varying degree or not at all; 29 per cent are permitted time in which to do graduate work. Four men receive full pay while doing such work. The rest receive half pay or none at all.

The average years of service spent by the men in this class in official entomological work is 18.6. The average years spent in their present position is 11.9. The average years of college preparation before taking professional position is 5.7 years.

Class II

In Class II, 66 replies are tabulated; 11 of these men are doing teaching; 17 are doing experiment station work; 10 are in state departments or are doing inspection service; 44 are in the federal service

The average total salary received by men in Class II, including outside compensation, is $2,069.73.

The average annual vacation allowed is 23.3 days. Of these men 22.7 per cent have opportunity to attend annual meetings, but only a part of these can draw their traveling expense on such attendance. In this group 10.6 per cent are allowed time for graduate work and of these one draws full pay while doing such work.

The average number of years that these men have been engaged in professional

work since completing their training is 10.4 years. The average number of years spent in present position is 6.4 years. The average number of years spent in college preparation is 5.4 years. The average mimimum salary desired by men in this group is $3,024.

Class III

One hundred and fifteen replies are included in the returns under Class III. Of these, 17 are doing some teaching; 24 are doing experiment station work; 36 are in state departments or inspection work; and 60 in the employ of the Federal Bureau.

The average total salary now received in this class is $1,704.

The average annual vacation is 20 days. Of the men in this class 17.3 per cent are allowed time in which to attend annual professional meetings, but of these only four receive their expenses at such meetings. Leave of absence for graduate study is allowed to 13.9 per cent.

The average number of years that the men in this group have already spent in professional work is 6.7 years. The average length of time that they have occupied their present position is 4.1 years. The average length of time spent in undergraduate and graduate training is five years.

The average minimum salary desired by men in this group is $2,419.

The committee recommends that the data herein set forth be delivered to the committee on resolutions for recommendation at the final session.

W. C. O'KANE,
A. G. RUGGLES,
H. J. QUAYLE,
E. C. COTTON,
W. E. BRITTON,
A. F. BURGESS,
Committee.

It was voted that the report of the Executive Committee be accepted and the recommendations be adopted.

PRESIDENT W. C. O'KANE: The next is the report of the Employment Bureau, which will be read by the Secretary.

REPORT OF ENTOMOLOGISTS' EMPLOYMENT BUREAU FOR YEAR OF 1919

AUBURN, ALA., December 24, 1919.

During the past calendar year the work of the Employment Bureau has reflected "after the war" conditions in many ways. Numbers of men who had been in army service returned to civilian life and a number of these sought the service of the Bureau in locating employment again. Many who are known to be "out of service" have failed to inform the Bureau of their new addresses and we are unable to get into communication with them again as we would like to do. In June, 1919, fewer of the newly graduated men enrolled than usual. Naturally there are many more calls for men who are starting work at comparatively low salaries than for the highly paid positions. The scarcity of men available in the lower class has, therefore, made it impossible for us to furnish names as desired by employers in a number of cases. Many of the men who would seem to be starting in entomological work indicate minimum salaries that they will consider which are much higher than has been the case in previous years. There are many indications that employers of entomologists must provide higher salary rates than formerly as is being done in most other professions and occupations.

During the year, 19 men have enrolled, of which number two are "reënrollments" indicating that men who have received 10 references through the Bureau, although they have not been placed in a new position thereby, are so well satisfied that they wish to continue the services of the Bureau. Undoubtedly in very many cases the prospect of a new position has led to the offer of increased salaries to hold desirable men in the positions which they already occupied.

There are now about 70 names on the rolls of the Employment Bureau. During the year, at least four men have been placed in new locations through the work of the Bureau, and possibly others of whose appointments we have not been informed. Altogether 83 references have been given requiring considerable time and correspondence.

The balance of "cash on hand" has shown a slow but steady increase since the beginning of the Bureau work. Accordingly, I would ask the Association to take action indicating whether they desire to have a policy adopted of increasing the number of references given for one enrollment fee beyond the 10 now given for the fee of $2, or if this seems to be a reasonable and satisfactory service, to decide whether, as a slight compensation to the person in charge of the Bureau, the sum of 10 cents per reference shall be set aside so long as, and *only when*, there shall be funds on hand to meet first and fully all other expenses incurred ordinarily in the conduct of the Bureau work. Hitherto the services of the men in charge have been given entirely gratis and only stenographic assistance has been paid for.

The financial statement is attached hereto:

Financial Statement for 1919

Receipts:		
December 24, 1918, to cash balance on hand	$43.30	
To 19 enrollment fees at $2	38.00	
Total		$81.30
Disbursements:		
By stenographic service (voucher 1)	$16.30	
By postage (voucher 2)	4.07	
By stationery (voucher 3)	2.00	
Total		22.37
Balance, cash on hand, December 24, 1919		$58.93

(*Note.*—Check for cash balance is attached hereto and payable in case the Association desires to transfer the administration of the Bureau to any other party, as I would personally be glad to have done.)

Respectfully submitted,
W. E. HINDS, *In Charge.*

ST. LOUIS, MO., December 31, 1919.

We, the auditing committee, have examined the report herewith submitted and find it correct.

E. G. KELLY,
J. S. HOUSER,
Auditing Committee.

MR. E. P. FELT: I think it would be desirable to accept the report with the modification that the modest compensation mentioned

be allowed and that the financial part be referred to the Auditing Committee.

A motion was made to that effect and it was so voted.

SECRETARY A. F. BURGESS: At the close of the report, Dr. Hinds stated that he would like to be relieved of conducting the Employment Bureau. For the information of the members, I will say that the director of the Employment Bureau is not elected annually by the Association, but serves without a definite term of office. It seems to me that as a matter of good policy, arrangements should be made for having a definite term of office for the director of the Bureau. This is no reflection on Dr. Hinds or his work, but simply a matter of good business policy. Possibly this could be referred to the committee on resolutions for adjustment.

PRESIDENT W. C. O'KANE: We will now hear the report of the Committee on Nomenclature.

REPORT OF THE COMMITTEE ON NOMENCLATURE

Out of the total number of common names of insects submitted to the committee by different members of this Society the following list has been prepared and recommended for consideration and adoption. A few of the names presented were not included by the committee for various reasons, perhaps the larger number being excluded on account of the use of the generic name as a common name.

In addition to the list of names submitted the committee makes two general recommendations for your consideration: (1) that the term *grasshopper* be substituted for *locust* when writing of any species of grasshoppers; and (2) that the term *aphid* be substituted for *aphis* when discussing any species of *aphids*.

The committee also recommends the adoption of the following changes in the names of two common pests:

Alfalfa leaf-weevil to alfalfa weevil—*Phytonomus posticus* Gyll.
Harlequin cabbage bug to Harlequin bug—*Murgantia histrionica* Hahn.

Finally, the committee recommends the publication in the Proceedings of the names in this list that are adopted together with all of the common names that have been presented in the ten previous lists:

Argentine ant—*Iridomyrmex humilis* Mayr.
Australian-pine borer—*Chrysobothris impressa* Fab.
Banana root-borer—*Cosmopolites sordidus* Germ.
Beautiful hickory-borer—*Goes pulchra* Hald.
Black thread-scale—*Ischnaspis longirostris* Sign.
Camphor thrips—*Cryptothrips floridensis* Watson.
Carpenter worm—*Prionoxystus robiniae* Peck.
Citrus black-fly—*Aleurocanthus woglumi* Ashby.
Cocoanut mealy-bug—*Pseudococcus nipae* Mask.
Cuban-laurel thrips—*Gynaikothrips uzeli* Zimm.
Elm borer—*Saperda tridentata* Oliv.
Elm sawfly—*Cimbex americana* Leach.
Elm leaf-miner—*Kaliosysphinga ulmi* Sund.
Elm case-bearer—*Coleophora limosipennella* Dup.

Gall-making Maple-borer—*Xylotrechus aceris* Fisher.
Globose scale—*Lecanium prunastri* Fonsc.
Grass thrips—*Aphanothrips striata* Osb.
Green shield-scale—*Pulvinaria psidii* Mask.
Hickory bark-beetle—*Eccoptogaster* (*Scolytus*) *quadrispinosus* Say.
Irrorate leaf-hopper—*Phlepsius irroratus* Say.
Larch case-bearer—*Coleophora laricella* Hbn.
Lilac-borer—*Podosesia syringae* Harris.
Linden-borer—*Saperda vestita* Say.
Locust-borer—*Cyllene robiniae* Forst.
Mango seed-weevil—*Sternochetus mangifera* Fab.
Meadow plant-bug—*Miris dolabratus* L.
Mining scale—*Howardia biclavis* Comst.
Papaya fruit-fly—*Toxotrypana curvicauda* Gers.
Pineapple black-weevil—*Metamasius ritchei* Mar.
Poplar borer—*Saperda calcarata* Say.
Pyriform scale—*Pulvinaria pyriformis* Ckll.
Red-banded thrips—*Heliothrips rubrocinctus* Giard.
Saddled leafhopper—*Thamnotettix clitellarius* Say.
Sericeous palm-weevil—*Metamasius sericeus* Ol.
Six-spotted leafhopper—*Cicadula 6-notata* Fall.
Sugar-maple borer—*Plagionotus speciosus* Say.
Sweet-potato weevil—*Cylas formicarius* Fab.
Twig girdler—*Oncideres cingulatus* Say.
Two-lined chestnut-borer—*Agrilus bilineatus* Web.
West Indian fruit-fly—*Anasthrepha fraterculus* Wied.

Respectfully submitted,

GLENN W. HERRICK,
EDITH M. PATCH,
Z. P. METCALF,
Committee.

Inasmuch as the recommendations in this report provided for the publication of all the common names of insects which had been adopted by the Association, a general discussion followed. It was voted that the list presented by the committee be adopted and the recommendations concerning the use of the word "grasshopper" instead of "locust" and the word "aphid" instead of "aphis," be approved and that this list combined with those names that had previously been adopted, be printed and copies reserved for sale.

PRESIDENT W. C. O'KANE: We will now hear the report of the Committee on Policy.

Mr. E. D. Ball presented the committee report. It was voted that this report be referred back to the committee to be presented in final form at the last session of the meeting.

PRESIDENT W. C. O'KANE: We will now have the report of the Committee on Entomological Investigations.

MR. GEORGE A. DEAN: In view of the fact that the Committee

on Policy has made provision for a sub-committee on entomological research and standards, and since the Committee on Entomological Investigations find that after interviewing a number of the members of the Association, they believe that this sub-committee is in a position to handle this work, your Committee on Entomological Investigations has decided to make no report. In view of the facts your committee would like to suggest that the Committee on Entomological Investigations be discontinued. This report is signed by myself as chairman, and Messrs. P. J. Parrott and W. J. Schoene. I move that the report be accepted and the matter of discontinuing this committee be referred to the Committee on Resolutions for later report.

The motion was carried.

PRESIDENT W. C. O'KANE: I will now call for the report of the Committee on U. S. National Museum.

REPORT OF THE COMMITTEE ON U. S. NATIONAL MUSEUM

The following information has been gathered, carefully studied and approved by your committee.

CONCEPTION OF THE DUTIES OF THE NATIONAL MUSEUM

The duties of the National Museum in relation to entomology are, we believe, to act as:

1. A national repository for the insect collections, the primary goal being to have as complete a representation of the fauna of the North American continent as possible, but emphasis to be placed also on the completeness of the collections from the entire world for reasons noted later. The Museum should also be a national repository for types of American species.

2. An investigational institution where the staff, Bureau of Entomology workers, other entomologists and advanced students could be provided with ample and satisfactory rooms for investigations on insects.

3. An educational institution for the laymen. This would necessitate popular exhibits illustrating the variety of insects, and the importance of their relation to human existence and interest.

The duties are indirectly stated in the 1918 Repprt of the U. S. National Museum.

IMPORTANCE OF INSECTS IN NATURE STUDY

The importance of insects to nature study is evident to everyone. The enormous number of individual species in comparison with the number of species of other animals or plants, their wonderful and remarkable variations and adaptations, and their relations and interrelations to all nature are evidence of the need of a more general knowledge of insects among laymen. This is more evident to the practical entomologist who every day realizes, from personal contact, the value of a general and correct knowledge of insects to enable the individual to comprehend and apply control measures.

IMPORTANCE OF INSECTS FROM THE PURELY ECONOMIC POINT OF VIEW

Probably no other factor in nature is more closely related to human existence than are insects, with the possible exception of human diseases. The success or failure of

the fruit crop or of the wheat or corn crop may be and often is wholly dependent on the effectiveness of artificial or natural control measures. The prevalence of many human diseases is wholly dependent on the prevalence of one or another insect.

Importance of the Museum to Economic, Scientific and Popular Entomology

The systematic study of insects is directly related to all phases of entomology, indeed the foundation of all insect studies is the classification. We must know the insect before deeply engaging ourselves with the problem. In the case of newly introduced insects early recognition is of greatest importance and this fact alone justifies the building up of a collection representative of the entire world. Federal, state, experiment station, and other entomologists throughout the country depend largely on the experts working in the U. S. National Museum for identifying insects, especially those little known.

Financial Support. The National Museum supports the Division of Insects to the extent of furnishing one associate curator and two preparators which amounts to an expenditure of approximately $4,200. The Bureau of Entomology furnishes about fifteen entomologists and as many preparators, an amount approximating $39,000, whose work consists primarily in keeping the collections of the various orders and determining the material for workers of the Bureau and for entomologists elsewhere. The funds furnished by the Bureau amount to about 7 per cent of their total income for general expenses, while the amount paid by the National Museum to the Division of Insects is only 1.4 per cent of its income for the preservation of collections.[1] For the past fiscal year the Museum was allotted $300,000 for the preservation of collections. In general it might be assumed that each of the three departments of the Museum would get $100,000. Certainly the Biological Department not less since the preservation of their collections is a larger item than the similar needs of the other two departments, and since there are seven divisions in the Department of Biology we should expect the Division of Insects to receive not less than one-seventh of the total income or $14,285. On the basis of importance, from the standpoint of human interest, economically and otherwise and the needs of taxonomic work on insects this division should receive a much larger proportion of the funds available. In justice to the other divisions it should be added that the above comparison is made not to minimize the importance of any division. There is not a division of the Museum work which does not deserve all of the funds at present allotted and more.

Needs of the Museum Summarized

From a study of the Insect Division of the U. S. National Museum and personal observations and facts offered by those in a position to know, your committee summarizes the needs of the Museum as follows, listed in the order of their importance:

1. More space for workers, including students as well as regular employees, and for the collections and popular exhibits. The Museum rooms are greatly crowded, the rooms are poorly lighted, and we are informed were marked "attic" on the architect's plans and were never intended for scientific work-rooms.

2. More custodians to care for the collections and to handle the large volume of material sent in for identification. Promptness in the identification of insects has a direct bearing on the prosperity of the country since delay may result in the secure

[1] In addition to the salaries indicated the National Museum expends between $1,000 to $3,000 per year on cases, supplies, etc., bringing the total support to about $7,000, but apparently this does not reduce the per cent of total income as the National Museum budget calls for a separate appropriation for "Furniture and Fixtures," and for "books."

establishment of a serious pest in some section of the country heretofore uninfested. There should be one institution in this country with a sufficiently large number of specialists to exert a very decided influence upon our systematic work, and the National Museum is the logical institution.

3. Entomologists should be assured of sufficient space and custodians to properly and permanently care for large and small donations of specimens and regulations which will be sufficiently rigid to prevent the loss or misuse of materials. It is known that the National Museum has not secured large and irreplaceable collections, because there was little assurance that they would be cared for to the best advantage and this condition is bound to continue and the Museum will not receive collections which would otherwise be bequeathed until the Museum is able to offer the necessary facilities and safeguards.

4. Popular exhibits, already alluded to, are essential to the popularity and success of any Museum aside from the reasons already advanced for such exhibits. There is need of several specialists to prepare entomological exhibits at least comparable with similar exhibits in the larger museums of the nation.

5. Funds should be available to purchase collections. Occasionally collections containing large numbers of types of American insects, or containing material otherwise difficult to secure are obtainable only by purchase.

6. A systematic effort should be made to have as complete a representation of the American fauna as possible. The present force is inadequate to consider such an effort.

7. Funds should be available to enable the employment of a regular collector or collectors for making collecting expeditions, first consideration to be given to completing the collections from the North American continent, but later this should be enlarged to include the entire world.

8. Proper and legitimate expansion of the Insect Division of the Museum calls for greater space and more satisfactory working quarters as already stated and with this very evident need in mind the future plans for the Museum should include the erection of a separate building for insects.

In conclusion your committee would urge entomologists to furnish the National Museum with types or cotypes of species described by them as well as duplicate representatives of groups being worked up, and to coöperate with the Museum authorities in every possible way. Your committee has every confidence in the ability of those in charge of the affairs of the Division of Insects, of the Department of Biology, and of the Museum itself, but it realizes further that they alone are powerless to institute the many needed reforms without the thorough coöperation, assistance and support of all entomologists and those interested in the welfare of entomology.

Respectfully submitted,

J. J. Davis,
V. L. Kellogg,
E. P. Felt,
Herbert Osborn,
E. D. Ball,
Committee.

Mr. J. J. Davis: I would like to offer as a member of the committee, a resolution which I think has a direct bearing and should be considered at the same time that we consider this report. The reason we believe it is well to consider such a resolution is the fact that it is going to be impossible to secure results simply by approving a report

of any committee. It is essential that we get to work, every one of us, and do everything we can to urge better facilities at the National Museum.

Resolved, That owing to the urgent needs of the Division of Insects, U. S. National Museum, the Museum Committee be empowered to join with the Museum Committee of the Entomological Society of America in preparing and printing a concise conference report based on two above mentioned committee reports, this printed report to be used for publicity purposes.

Further resolved, That the National Research Council be informed of the needs of the National Museum and the importance of the Division of Insects to every phase of entomology and their consideration of this matter and their support be urged.

Further resolved, That entomologists in all states be urged to use their influence in impressing upon their national legislative representatives the importance of this matter; also that on account of the direct and important bearing of the museum work on economic entomology of the entire United States the members of this Association be strongly urged to secure the endorsement of the State Horticultural and Agricultural Societies.

After general discussion, it was voted that the report of the committee be accepted, and that it be authorized to prepare a statement to be submitted to the Association at the final business session.

PRESIDENT W. C. O'KANE: We will now have the report of the Committee on Index of Economic Entomology.

REPORT OF THE COMMITTEE ON THE PUBLICATION OF THE INDEX OF AMERICAN ECONOMIC ENTOMOLOGY

Carrying out the instructions of the last annual meeting, your committee arranged with Dr. L. O. Howard, chief of the Bureau of Entomology, for the compilation of the index for the years 1915 to 1919 inclusive, with a view of having it completed and published early in 1920.

Miss Mabel Colcord was detailed to take charge of this work and she estimates that there are now about twenty thousand references with presumably two to four thousand yet to be entered and a fair prospect of its being completed the latter part of January. Figuring on the basis of the 1905–14 index, this would mean a volume of approximately 250 pages, which agrees exactly with our estimate of a year ago.

The printer's charges for an edition of one thousand copies, 400 bound, of substantially the same character as the preceding volume, would be, at current prices, $1,550 for a volume of 250 pages. There would be some expense for author's corrections, the proofreading, postage, etc. The total cost can hardly be less than $1,800. We could not count, as with the preceding index, on selling more than 300 copies at the outset, though the probabilities are good that a large number could be sold within a five-year period.

The total cost of one thousand copies of the 1905–14 index, including the binding of three hundred (the remainder were held unbound until needed) was $1,212.99. The advance subscription rate, limited to members and to be accompanied by a remittance prior to a stated date, was fixed at $4.00 and after that the price was advanced to $5.00 for domestic and $5.50 for foreign subscriptions. There were 161 copies sold to advance subscribers and 58 additional to others prior to December 7 of that year. The receipts from sales amounted to $928.49 (including $15.51 which

remained in the index fund), leaving a balance against the work of $284.49. Up to December 11, 1919, the sales for 1919 amounted to $223.35. After paying for postage, insurance, cartons for shipping the books and returning $200 to the Association fund, there is a balance of $25.72 in reserve. The 1905–14 index fund still owes the Association $100 and if the number of sales of this year can be duplicated in the next, the indebtedness of the index will be cancelled.

The committee recommends that it be continued to supervise the completion of the index manuscript and that the editorial board of the JOURNAL OF ECONOMIC ENTOMOLOGY be authorized in its discretion to proceed with the publication of the index and to fix, as heretofore, the conditions of sale, it being expected that the terms formulated will result eventually in full reimbursement of the Association.

Respectfully submitted,

E. P. FELT,
A. F. BURGESS,
W. C. O'KANE,
W. E. BRITTON,
W. E. HINDS,
Committee.

On motion it was voted to adopt the report.

SECRETARY A. F. BURGESS: The adoption of this report carries with it the publication of the next issue of the index. In order to carry this project through, it will be necessary to secure 300 paid subscriptions from members of the Association at $4.00 each, in order to get a working fund sufficient to finance the undertaking. Before the last index was issued, 161 advance subscriptions were secured from members. It will be necessary to practically double this number in order to finance the new volume.

PRESIDENT W. C. O'KANE: I will call for the report of the Committee on Amendments to the Constitution.

REPORT OF THE COMMITTEE ON CONSTITUTIONAL AMENDMENTS

Careful consideration has been given to the proposed revisions of the Constitution, as published in the program of the thirty-second annual meeting of this Association. As the proposals involve a radical departure in the administration of the affairs of the Association, the committee is not now prepared to recommend the adoption of the proposed amendments. The committee wishes it understood that this action does not prejudice any efforts, either of a similar or different sort, that may be made in the future to promote the work of the Association as embodied in the original suggestions for the appointment of a Committee on Policy. The committee, moreover, desires to express its hearty approval of the underlying motives of the proposed revisions—to promote research, stimulate progress and encourage concentration of efforts. As the Committee on Policy has shown capacity to render great service along these lines as a standing committee and is accomplishing the ends intended, it is deemed unwise to introduce fundamental changes in the Constitution which might prove difficult to correct.

P. J. PARROTT,
GEORGE A. DEAN,
WM. A. RILEY,
Committee.

By vote of the Association the report of the committee was adopted.

PRESIDENT W. C. O'KANE: The chair will announce the following committees:

Nominations: E. C. Cotton, J. J. Davis, P. J. Parrott.

Resolutions: A. G. Ruggles, G. A. Dean, J. G. Sanders.

Auditing: E. G. Kelly, J. S. Houser.

Temporary representative to serve as a member of the council to the American Association for the Advancement of Science on account of the absence of Professor Gillette: S. A. Forbes.

PRESIDENT W. C. O'KANE: Is there any miscellaneous business?

MR. LEONARD HASEMAN: The Secretary of the Board of Agriculture is considering the desirability of reprinting the Riley reports. If the members of this Association, especially the younger ones, are interested in securing these reports, a resolution concerning them might help materially in having them published.

PRESIDENT W. C. O'KANE: As there is no motion, the matter will be referred to the Committee on Resolutions for consideration.

SECRETARY A. F. BURGESS: I would like to bring before the Association the condition in which we find ourselves in connection with the gipsy moth work in New England.

Our appropriations have remained stationary. Our problem has not decreased in size. Our expenditures have increased upon all items. Unless we have more money, we cannot do the volume of work that we should do. I have talked with Dr. Howard in regard to this matter, and he is favorably disposed to the proposal of having an additional appropriation of $100,000 for the coming fiscal year. Unfortunately this amount has been dropped from the estimates. The increased cost in wages, supplies, etc., amounts to over 30 per cent and it will probably be necessary to increase still more before the end of another year. We are paying lower than normal rates at the present time. I understand that there is a possibility that a supplemental estimate can be put in, and I would like to interest the members of this Association in the matter because we are facing a crisis in this work.

PRESIDENT W. C. O'KANE: This matter will also be referred to the Committee on Resolutions.

At the Friday morning session, at the request of the President, First Vice-President Ruggles and Past President Osborn were requested to escort Dr. Howard to the platform, where he was introduced by the President as the newly-elected President of the American Association for the Advancement of Science. He responded as follows:

Mr. President and Fellow Entomologists:

I did not expect to be exhibited this morning. I, of course, am enormously gratified at the personal compliment which the council paid me in electing me president

of the Association, but aside from the personal compliment, there is something very much stronger. It means that, as a class among scientific men, we have been coming for a long time with increasing rapidity and that we have gained by our sound scientific work the confidence of our fellow workers in other branches of science. That means a great deal. It is one thing to gain public confidence, but down in the bottom of our hearts we want the confidence in the value of our scientific work and the perfection of our methods in men who are working with other and older branches of science. I think it is not me who is to be congratulated, so much as the whole group of entomologists, economic and pure. (Applause.)

MR. H. A. GOSSARD, one of the representatives of this Association on the council of the American Association for the Advancement of Science, stated that he had been endeavoring to go over the lists of the Association in order to arrange for the promotion of all of our members who are entitled to receive fellowships in the American Association for the Advancement of Science.

Mr. Gossard stated that it was quite a complicated task and that it would take considerable time, hence he doubted whether it would be possible to make an entire adjustment of the matter at the present meeting.

At the afternoon session, Friday, the closing business was transacted.

PRESIDENT W. C. O'KANE: I will call for the report of the Auditing Committee.

AUDITING COMMITTEE

ST. LOUIS, MO., December 31, 1919.

We, the undersigned, as auditing committee, have examined the accounts of the treasurer of the Association of Economic Entomologists of America, of the JOURNAL OF ECONOMIC ENTOMOLOGY, the Index of Economic Entomology, and of the Entomologist Employment Bureau and have found them correct in every detail.

E. G. KELLY,
J. S. HOUSER,
Committee.

It was voted that the report of the committee be adopted.

PRESIDENT W. C. O'KANE: You will now listen to the report of the Committee on Resolutions.

REPORT OF COMMITTEE ON RESOLUTIONS

Your Committee on Resolutions begs leave to submit the following report, which for clarity and convenience is separated under the following heads: *Resolved,*

(1) That we express our appreciation to the local committee composed of George T. Moore, Alexander S. Langsdorf, Augustus G. Pohlman, John W. Withers and John Wulfing, who had charge of arrangements in St. Louis for the thirty-second annual meeting of the Association of Economic Entomologists.

(2) That the Secretary be authorized to prepare a suitably engraved certificate to be presented to all living past presidents, and that this presentation be established as a custom for the future.

(3) That the Employment Bureau be discontinued, and that the money be returned to those registrants who have credit with the Bureau.

(4) That since the Committee on Policy has made provision for a sub-committee on entomological research and standards, the Committee on Entomological Investigations be discontinued.

(5) That a material advance in the scale of compensation of entomological workers is essential to the present and future welfare of this important branch of science.

That the following schedule of salaries is endorsed by this Association as reasonable compensation for efficient professional services in entomology:

A. *Chief Executive:* In administrative and technical charge of a major organization, involving extensive executive responsibility, and the determination and direction of broad policies and undertakings; salary $7,500 and up.

B. *Department or Division Head:* In administrative and technical charge of a major division or department of an organization, involving full responsibility for its direction; salary $4,000 and up.

C. *Associate, or Senior Assistant:* Under general administrative direction of a department or division head, and responsible for the technical direction of a considerable subdivision; salary $3,000 and up.

D. *Assistant:* Under specific administrative direction and performing prescribed technical duties; salary $1,800 and up.

That the Association and its members earnestly urge the adoption of the above schedule throughout the country.

(6) That active membership in our Association should be maintained as an honor due to high grade work and constantly maintained interest in the furtherance of our Association and its ideals. Unless such a high standard is maintained active membership will have no significance.

(7) That this Association unites with the Entomological Society of America in the publication and distribution of a concise conference report based on the reports of National Museum committees of the two associations, calling attention to the urgent needs for greatly increased facilities for the Division of Insects.

Further, that this need be communicated to the National Research Council with an urgent plea for council support in improvement of facilities for entomology.

(8) That since we feel it necessary to the best interests of this Association and the furtherance of economic entomology in the United States, that divisional heads in the U. S. Bureau of Entomology be present and take part in our annual meetings, the Department of Agriculture can well afford to grant leave of absence on full pay, and meet the expenses of such officials for such purpose, even if it is deemed necessary to curtail the present extensive travel of minor assistants.

(9) That the phrase in the motion which established the Committee on Policy at the thirty-first annual meeting, as follows: "The originating and directing of all policies of the Association and its various undertakings" be stricken out, for the purpose of clarity and to avoid repetition.

(10) That this Association heartily approves the proposed reprinting of the Riley Missouri Reports.

(11) That inasmuch as the further spread of the gipsy moth and the brown-tail moth is a menace to the agricultural, horticultural and forestry interests of the United States, and since cost of operation has greatly increased, and thus made it impossible to conduct the work against these insects with the appropriation now available, this Association favors an additional appropriation by Congress of $100,000 for the Bureau of Entomology, to be devoted to this important work, and further, that this Association take every reasonable measure to support this appropriation.

(12) WHEREAS, The Federal Horticultural Board has, through its quarantine service, rendered valuable protection to the agricultural interests of the United States, and

WHEREAS, The present quarantine service of the Board is not at present adequate, because of insufficient funds, to properly safeguard the country against the importation of new pests, therefore, the American Association of Economic Entomologists requests Congress to appropriate and make available the sum of $200,000 for the ensuing fiscal year, for the use of the Federal Horticultural Board in extending and developing an adequate port inspection and quarantine service at all ports of the United States, and that copies of this resolution be furnished to the chairmen respectively of the Agricultural Committees of the House and Senate, the Honorable Secretary of Agriculture and the Chairman of the Federal Horticultural Board.

(13) That this Association unite with the Phytopathologists, Horticulturists and other associations in full coöperation with the American Plant Pest Committee in its publicity and legislative efforts for the protection of America from destructive plant pests.

(14) That our Association representative to the National Research Council be an ex-officio member of our Committee on Policy.

(15) That the proposition of Prof. Frank R. Lillie, Chairman of the Committee on Coöperation and Coördination of the Division of Biology and Agriculture of the National Research Council, urging this Association to coöperate with the National Research Council, be referred to our Committee on Policy with power to act.

A. G. RUGGLES,
G. A. DEAN,
J. G. SANDERS,
Committee.

The resolutions were adopted unanimously and without comment, with the following exceptions:

Resolution 3 on discontinuing the employment bureau was discussed briefly and was adopted by a vote of 22 for, 9 against.

Resolution 5 was discussed briefly and the point was made that the adoption of this resolution might have a bad, rather than a good effect, in bringing about increased compensation for entomologists. It was adopted, however, without change.

Resolution 7 was discussed briefly, the point being made that some men in the United States Bureau of Entomology did not attend the meetings of this association because they could not obtain proper authorization from the Department of Agriculture.

PRESIDENT W. C. O'KANE: Is the Committee on Membership ready to report?

REPORT OF THE COMMITTEE ON MEMBERSHIP

Your committee has given careful consideration to the matters before it, and begs leave to submit the following report:

It recommends that the fifty-one applicants be elected to associate membership as follows:

Anderson, Charles S., Arlington, Mass.
Armitage, H. M., Alhambra, Cal.
Babcock, Kenneth W., Arlington, Mass.
Bailey, Harold L., Bradford, Vt.

Bauer, Frederick, Storrs, Conn.
Blanchard, Ralph A., Webster Groves, Mo.
Brock, A. A., Santa Paula, Cal.
Chamberlain, Kenyon F., New Haven, Conn.
Chambers, Ernest L., Washington, D. C.
Cook, William C., Univ. Farm, St. Paul, Minn.
Craig, Dexter H., Arlington, Mass.
Dean, M. L., Olympia, Wash.
De Ong, E. R., Davis, Cal.
Deputy, O. D., Laredo, Texas.
Eyer, J. R., Girard, Pa.
Fackler, Harry L., Knoxville, Tenn.
Grimes, D. W., Agricultural College, Miss.
Gunderson, A. J., Cleveland, Ohio.
Hoddy, E. J., Knoxville, Tenn.
Hodson, Benjamin E., Arlington, Mass.
Hofer, C. E., Arlington, Mass.
Hoffman, William A., Washington, D. C.
Hoffmann, William E., Lawrence, Kan.
Horsfall, J. L., Dubuque, Iowa.
Kennedy, Clarence H., Columbus, Ohio.
Kimball, Hunter H., Agricultural College, Miss.
Knapp, C. W., Arlington, Mass.
Lobdell, Richard N., Agricultural College, Miss.
Lockwood, Stewart, Agricultural College, N. D.
McIntyre, Henry L., Melrose Highlands, Mass.
McMahon, E. A., Annapolis Royal, N. S.
Montgomery, J. H., Gainesville, Fla.
Mosher, Edna, Albuquerque, N. M.
Nickels, Clarence B., College Park, Md.
Nininger, Harvey H., Winfield, Kan.
O'Rourke, Francis L., Arlington, Mass.
Palmer, Ralph G., Ithaca, N. Y.
Partridge, Newton L., Newark, Del.
Price, Walter A., La Fayette, Ind.
Ressler, I. L., Ames, Iowa.
Searls, Edward L., Schaghticoke, N. Y.
Simmons, Perez, Alhambra, Cal.
Smith, Ralph H., Twin Falls, Idaho.
Spencer, Herbert, West Raleigh, N. C.
Stirling, Frank, Gainesville, Fla.
Taft, L. R., East Lansing, Mich.
Taylor, Leland H., Boston, Mass.
Warren, Don C., Valdosta, Ga.
Watts, H. R., Knoxville, Tenn.
Whitcomb, Warren D., Yakima, Wash.
Winchester, Harry I., Wakefield, Mass.

A circular letter was sent to each of the associate members asking those who have not already done so, to file with the membership committee, data regarding their training and experience, list of publications, and, where possible, a copy of each, so that the members of this committee may have more adequate information about the work that our associate members are doing, with a view to possible promotion to active membership. Of the 303 associate members, 161 or 53 per cent have filed statements, and 44, or 14 per cent have sent publications. The committee again asks the associate members to file such information for the future use of the committee.

Several letters have been received from associate members, criticising the policy of the Association in regard to promotions to active membership. In explanation of this policy, the committee wishes to again point out that for several years an arrangement has existed whereby all active members are eligible to be made Fellows in the American Association for the Advancement of Science, without the necessity for further investigation.

In other words, active membership means something.

It should be borne in mind that this is an association of economic entomologists. All active members through their investigations and publications, or teaching, or control work, are supposed to have added to our knowledge of the subject. There are several systematists and workers in other lines of natural science on our list of associate members; men whose training, experience and achievement are of high order. Such members, so far as scholarship is concerned, would surely be eligible for promotion, but we cannot substitute some other line of endeavor in place of that for which this Association was formed.

Where associate members neglect to file statements or publications, your committee

is not always familiar with their achievements, and this should explain why they are not selected for promotion.

Furthermore certain associate members are in arrears on the secretary's books, and for this reason even though they fulfil all other requirements, are not recommended for promotion. Notwithstanding the present high cost of living, if a man wishes to be an active member in this Association, he must pay his dues.

Your committee believes that the following 31 men have fulfilled all requirements, and recommends that they be transferred from associate to active membership:

Abbott, W. S., Vienna, Va.
Barber, E. R., New Orleans, La.
Bourne, A. I., Amherst, Mass.
Campbell, Roy E., Alhambra, Cal.
Chapman, Royal N., Minneapolis, Minn.
Childs, LeRoy, Hood River, Ore.
DeLong, Dwight M., Harrisburg, Pa.
Ferris, G. F., Stanford University, Cal.
Fink, D. E., Riverton, N. J.
Fracker, S. B., Madison, Wis.
Freeborn, S. B., Berkeley, Cal.
Gill, John B., Monticello, Fla.
Illingworth, J. F., N. Queensland, Australia.
Iseley, Dwight, Washington, D. C.
Leiby, R. W., Raleigh, N. C.
Newcomber, E. J., Portland, Ore.
Pellett, F. C., Hamilton, Ill.
Pemberton, C. E., Honolulu, H. T.
Safro, V. I., Louisville, Ky.
Scammell, H. B., Washington, D. C.
Severin, H. C., Brookings, S. D.
Severin, H. H., Berkeley, Cal.
Shelford, V. E., Urbana, Ill.
Simanton, F. L., Benton Harbor, Mich.
Tanquary, M. C., College Station, Texas
Treherne, R. C., Vernon, B. C.
Tucker, E. S., Tallulah, La.
Weiss, H. B., New Brunswick, N. J.
Woods, W. C., Orono, Me.
Yothers, M. A., Medford, Ore.
Zetek, James, Ancon, Canal Zone, Panama.

Three members have resigned from the Association, as follows: Charles J. S. Bethune (Active), Guelph, Can.; E. B. Engle (Associate), Harrisburg, Pa.; W. E. Evans, Jr. (Associate), Knoxville, Tenn.

Professor Bethune was one of the original members of this Association. The high cost of living is given as the reason for his request. As there is ample precedent for such action in this Association, your committee recommends that he be kept on our rolls, and his dues be remitted; also, that the resignations of Messrs. Engle and Evans be accepted.

Mr. S. Marcovitch, an associate member who resigned a year ago, now asks to be reinstated, and your committee recommends that his request be granted.

The following entomologists are recommended for election to foreign membership: Charles K. Brain, Pretoria, South Africa; Gerald F. Hill, Townsville, N. Queensland, Australia; Rupert W. Jack, Salisbury, Rhodesia, South Africa.

As two associate members have paid no dues, and as nine active and thirteen associate members are in arrears, your committee recommends that the Secretary be instructed to inform such members that if they do not remit within the coming year, their names will be dropped from the rolls.

Respectfully submitted,

W. E. Britton,
T. J. Headlee,
E. R. Sasscer,
Membership Committee.

By vote of the Association the report was accepted and the recommendations adopted, which carried with it the election of the members recommended.

President W. C. O'Kane: Are there other committees to report?

ENTOMOLOGY IN THE U. S. NATIONAL MUSEUM

The day has long passed when American scientific activities could be restricted to a narrow field. Whether we regard economic needs or intellectual development, we find ourselves compelled to consider the whole range of science limited only by our resources and the powers of the human mind. In the field of entomology this involves, among other things, access to adequate collections of insects, including not only those found in North America, but the species of the whole world. The leading European countries have long appreciated such needs, and have built up collections to which Americans have to make pilgrimages when engaged in comprehensive studies of insect groups. There is no reason why we should not possess facilities for work at least equal to those of any other country. We have the greatest resources of any nation at the present time, and certainly are not lacking in the ability to carry on the work.

The species of insects are far more numerous than those of any other groups of animals; in fact the described forms exceed those of all other groups combined. Very many of them are of supreme importance and interest to man, as destroyers of our crops, as carriers of the germs of disease, as enemies of injurious forms, or as sources of some of our most important economic products. All know the value of the silkworm or honey bee, but few realize the services of the host of parasitic insects, which keeps down the enemies of our crops, and without which agriculture would be impossible. All are aware that numerous insects are injurious to plants, but comparatively few know that many of the most harmful have been introduced from abroad. The greatest danger of our crops, or even to our health, may arise from insects accidentally brought from foreign countries through the operations of commerce. The San José scale came from Asia, the cottony cushion scale from Australia. The gypsy moth, which has cost this country hundreds of thousands of dollars, is European. The cotton boll weevil, even more to be dreaded, invaded the United States from Mexico and Central America. For urgent practical reasons, therefore, as well as in order to complete and organize our knowledge we need to know the insects of all countries, and to have them represented in at least one American collection. This obvious requirement cannot be met without Congressional aid. The National Museum, under present conditions, cannot possibly develop an adequate policy of entomological development. The two prime obstacles are lack of sufficient curators and lack of space. The present force, even with the great aid afforded by the members of the Bureau of Entomology, cannot arrange and classify the collections already on hand, inadequate as some of these are. Some of the men work overtime and on holidays, while help is sometimes obtained from those not officially connected with the Museum, but all these activities lamentably fail to cover the whole field. The Museum should have enough expert curators to keep classified and in order every group of insects, and to furnish identifications and other aid to economic entomologists and other workers in every state. Should the curatorial force be supplied, however, they would be helpless in the present crowded condition of the department. There is hardly room to move around, and almost no space for new cabinets. The only way out seems to be through the erection of a new building of suitable size; fireproof, but not necessarily of any great architectural pretensions.

Granting the building and the curators, with suitable rules and arrangements to ensure the proper care of all the collections, what more should be demanded? Undoubtedly collectors and students would present or bequeath their materials on a scale previously unheard of, because of the great services they had received from the Museum and their confidence in it as a repository of types and the priceless specimens. This, however, would not suffice. Funds should be available for explora-

tions, within the United States and abroad, to discover insects hitherto unknown or unrepresented in the Museum.

With curators, building, and adequate collections, we are still confronted by another urgent need. The results of the work done must be made available to scientific men in every part of the country. This can only be brought about through the creation of adequate publishing facilities, insuring the reasonably prompt appearance of each work completed. At the present time authors hesitate to undertake large monographs not knowing when they will see the light of publicity, nor indeed whether they will ever do so.

Prepared by the committees to investigate conditions and needs of the United States National Museum,

Entomological Society of America
T. D. A. COCKERELL,
HERBERT OSBORN,
WILLIAM BARNES,
WILLIAM M. WHEELER,
J. G. NEEDHAM,
Committee.

American Association Economic Entomologists
JOHN J. DAVIS,
VERNON L. KELLOGG,
E. P. FELT,
HERBERT OSBORN,
E. D. BALL,
Committee.

MR. J. J. DAVIS: The committee recommends that this report be accepted and that copies be submitted to the authorities of the Museum and requests the aid of all entomologists in the distribution of this information.

Voted that the report be accepted and the recommendations be adopted.

PRESIDENT W. C. O'KANE: We have yet to hear from the Committee on Policy.

REPORT OF THE COMMITTEE ON POLICY

Your Committee on Policy, following its appointment at the last session, promptly organized, elected a chairman, and proceeded to a consideration of the problems confronting the Association.

A preliminary canvass of the members resulted in the presentation of twenty-two more or less distinct problems for discussion.

A second canvass, in which an attempt was made to agree on a few of the more important ones for immediate consideration, was not as successful but finally resulted in an agreement on the division of the subject matter between five subcommittees, each subcommittee to proceed with the discussion and selection of important subjects within its own field.

The fields and subcommittee assignments are given below, it being understood that the chairman was to be ex officio member of each subcommittee and that the president held the same relation to those subcommittees to which he had not been regularly assigned.

1. Education: Osborn, Dean, Pierce.
2. Insect Control: Felt, Sanders, O'Kane.
3. Organization and Coöperative Relation: Sanders, Burgess, O'Kane.
4. Research Problems and Standards: Dean, Osborn, Parrott.[1]
5. Publications: Burgess, Pierce, Felt.

[1] Professor Parrott as the Association's representative on the National Research Council was asked to assist this subcommittee.

The committee, in studying the problems of entomological education, finds that there are two quite different fields to be considered. The first of these is the general teaching of the subject for the benefit of the general public whether in the public schools, colleges or extension courses. The second field lies in the training of specialists in entomology who are to be responsible not only for the instruction in this branch, but also for the imperatively necessary research which is to carry the subject beyond its present limits and to make secure its foundation in fundamental knowledge. The committee asks the assistance of all entomologists in its consideration of definite courses in entomology for the different needs. It also asks assistance in considering the desirability of fixing minimum standards of preparation, or the holding of a degree showing a certain amount of training in entomology, as a requisite to recognition as a professional entomologist.

Your committee recommends: 1. That all members of the Association be urged to give attention to the instruction now offered in secondary and rural schools in their respective localities to the end that the best possible instruction be secured under the conditions existing.

2. That extension entomology and the extension entomologist, in all institutions where such officers exist, be connected directly with the department including entomological instruction, in order to insure the closest agreement in the activities of the two fields of effort.

Through the subcommittee on research problems and standards, your committee is, at the present time, endeavoring to determine what are the major research problems and what should be the best method of attack. Your committee asks the aid and coöperation of research workers in arriving at a decision as to the problems of the greatest value or urgency. Your committee is coöperating with the National Research Council, through our representative, in the development of entomological research and its coördination with that of the allied sciences. Your committee is undertaking to stimulate coöperation and coördination in research activities upon insects of regional importance. It feels that efforts of this kind wisely and conservatively directed would result in the development of regional or group projects in which the determination of the factors needing investigation and the method of attack would largely be developed in group or regional meetings, and that conferences from time to time would tend to accelerate progress.

The subcommittee on insect control began activities as a special subcommittee on the European corn borer and was subsequently reorganized with a broader function. The corn borer problem, because of its urgency, has been given special attention. One or more members of the subcommittee have taken part in most of the recent meetings, hearings and conferences in relation to this pest and have coöperated with various agencies. The committee has supported efforts to secure appropriations commensurate with the magnitude of the project, and regrets that owing to a variety of causes a comparatively small sum was appropriated by Congress. It has doubtless rendered a valuable service in other directions, though it is difficult, in view of the coöperative character of its work, to definitely list what has been accomplished.

It is the opinion of this committee that the European corn borer must still be regarded as a most important and potentially very dangerous insect in spite of the fact that developments in eastern Massachusetts last fall showed considerably less injury than in 1918, and that in New York state but one generation, with very limited injury, developed.

Serious losses may be expected, in the opinion of this committee, in eastern Massachusetts as a rule, and if the pest becomes established in the corn belt, extensive injury may result.

Furthermore, it is held that the westernmost infestations, although sparse, are a greater threat to the corn crop of the country than the larger area in eastern Massachusetts and New Hampshire.

The committee favors an energetic effort by the general government to control and, if possible, eradicate these outlying infestations by a reasonable clean-up of the infested territory, supplemented by a large scale test of the efficacy of modified cropping and the early destruction of infested corn, especially in the very sparsely infested portions of this area.

The committee also recommends comprehensive measures in eastern Massachusetts to prevent an undue multiplication of the insect and a demonstration of the possibilities of controlling it by modifications in cropping and by the adoption of such other measures as may be practical.

Furthermore a federal quarantine is recommended, restricted as to area, and applying to corn on the cob and all other portions of the plant except shelled corn or milled grain and, if possible without serious commercial disturbances, the inclusion of other plants or plant products liable to be infested and commonly transported, such as broom corn, celery, chrysanthemums and gladioli except the bulbs thereof.

Since the efficacy of the above measures depends in a very large degree upon the closest possible coöperation between federal officials and the various state agencies, it is recommended that detailed plans for control work be formulated and made public as early as possible and used as a general guide, at least for operations in the infested territory.

It is further recommended that the secretary of agriculture be asked to reconsider the situation in view of the materially changed conditions resulting from investigations of the last few months, and that he be urged to request of Congress a special appropriation of $1,000,000 to be immediately available for cleaning up the infested territories in the early spring along lines substantially as outlined above, and that the secretary be urged to advise Congress that an equal amount for corn borer work should be included in the Agricultural Appropriation Bill, this latter to be available for a continuance of operation during the next fiscal year.

In view of the probability of other potentially injurious insects becoming established in this country in spite of quarantine and other precautions, and owing to the practical difficulties of securing immediate and effective action after the discovery of such an infestation, the committee would urge the desirability of the Bureau of Entomology having an emergency or reserve fund commensurate with the importance of the project, to be used for incipient work against such pest or pests, it being expected that later operations would be contingent upon the preliminary investigations and field operations, and cared for, as in the past, by special authorization from Congress.

E. D. Ball,
W. C. O'Kane,
A. F. Burgess,
E. P. Felt,
Herbert Osborn,
W. D. Pierce,
J. G. Sanders,
George A. Dean,
Committee.

On motion, the item in the report referring to proposed appropriation for the control of the European corn borer was amended by reducing the amount to be immediately available from $1,000,000 to

$750,000, and by striking out the request for a proposed appropriation of $1,000,000 for the next fiscal year.

It was voted to accept the report of the committee as amended.

PRESIDENT W. C. O'KANE: Is the advisory committee ready to nominate officers of the JOURNAL for the ensuing year?

MR. W. J. SCHOENE: On behalf of the advisory committee, I have the following report to make:

The advisory committee of the JOURNAL OF ECONOMIC ENTOMOLOGY nominates for editor of the JOURNAL OF ECONOMIC ENTOMOLOGY, E. P. Felt; for associate editor, W. E. Britton; for business manager, A. F. Burgess.

By vote of the Association the nominees were elected.

PRESIDENT W. C. O'KANE: Next we will have the report of the Committee on Nominations.

REPORT OF THE COMMITTEE ON NOMINATIONS

For President, Wilmon Newell.
First Vice-President, H. A. Gossard.
Second Vice-President (Pacific Slope Branch), E. M. Ehrhorn.
Third Vice-President (Horticultural Inspection Section), J. G. Sanders.
Fourth Vice-President (Apiculture Section), F. B. Paddock.
Member of the Committee on Policy, W. C. O'Kane.
Committee on Nomenclature, Arthur Gibson.
Committee on Membership, A. G. Ruggles.
Committee on U. S. National Museum, W. J. Holland.
For councillors to the American Association for the Advancement of Science, T. J. Headlee, G. A. Dean.
Advisory committee, JOURNAL OF ECONOMIC ENTOMOLOGY, L. O. Howard, R. W. Harned.
Representative on the National Research Council, P. J. Parrott.

Respectfully submitted,

E. C. COTTON,
J. J. DAVIS,
P. J. PARROTT,
Committee on Nominations.

By vote of the Association, the Secretary was instructed to cast the ballot of the Association for the nominees.

This was done and they were declared elected.

PRESIDENT W. C. O'KANE: I will request Past Presidents Britton and Felt to escort to the platform, President-elect Wilmon Newell.

MR. WILMON NEWELL: It is very difficult on an occasion of this kind to say very much. I am aware of the fact that you have conferred on me the highest honor that it is within your power to bestow. I am very deeply appreciative and I wish to assure you that I will give to the Association the best that I have, which is not very much, but

what is more important, I will try to get for you all that I can get out of somebody else. It is interesting to me that this has happened in the twentieth year of my entomological efforts. About all I can say now is that I hope all of you will be president of this Association by the time you have been at it twenty years.

PRESIDENT W. C. O'KANE: Is there any miscellaneous business?

SECRETARY A. F. BURGESS: A list has been passed around to secure subscriptions to the new index. The reduced rate of $4.00 is for members only. If we extend this rate to institutions, we immediately get into trouble with subscription agencies that handle some of our business. Any member can subscribe for as many copies of the index as he desires at the $4.00 rate, but he must pay for them personally, or if they are to be paid for by an institution, the order must state that they are for the use of a member, otherwise the full rate will be charged.

MR. J. G. SANDERS: I move that in the future we eliminate the purchase and use of numbered buttons. They are of some expense to the Association and about 20 per cent are usually used.

It was voted by the Association that this be done.

SECRETARY A. F. BURGESS: Inasmuch as we will have no more numbered buttons, I would like to ask if the Association cares to have the list of members and the list of meetings printed in the program. The program as printed with covers is more expensive than if the covers, list of members and list of meetings were eliminated. The list of members is printed largely because each member is numbered. I will take full responsibility for originating the button scheme and for printing the list of members, but I would like to know whether the association thinks the printing of this list is worth the price?

MR. J. G. SANDERS: I would like to see the list of members printed. It is very handy for reference at the meetings.

MR. E. C. COTTON: I would not like to see the list of members and list of officers and former places of meetings dropped.

By vote of the Association it was decided to print the program substantially as heretofore.

MR. H. A. GOSSARD stated that he had checked over the list of active members and that he had sent a list of those who were not fellows in the American Association for the Advancement of Science to that association so that they could be raised to fellowships, if they are in good standing on the books. He stated that he had done the best he could in the limited time at his disposal to straighten out this matter which proved to be quite complicated. He stated that he had attended many of the meetings of the council and was very glad to have had the privilege of voting for the first economic entomologist to be president of the general Association.

MR. HERBERT OSBORN: I move that the next meeting of the Association be held at the same time and place as that of the American Association for the Advancement of Science.

The motion was seconded and carried.

PART II. PAPERS AND DISCUSSIONS

Afternoon session, Wednesday, December 31, 1919, 1.30 p. m.

PRESIDENT W. C. O'KANE: The chair wishes to announce the matter of policy in regard to papers.

The time limit requested by the author will be allowed in each case and the time will not be extended unless by vote of the Association. If the author of a paper is not present when the paper is called, it will be passed to the end of the session. The papers left over will then be called in order. In the case of a paper sent in by a member who is not present, it will be read by title unless the Association votes otherwise. The chair believes that all members who attend the meetings and bring their papers should have preference over those who send them to the meeting.

I would like to announce an invitation to visit the Stark Bros., Nurseries and Orchards, at Louisiana, Mo.

We will now listen to a paper entitled, "New Facts Concerning the Habits of the Rocky Mountain Spotted Fever Tick, *Dermacentor venustus* Banks," by R. R. Parker.

THE PRESENT STATUS OF THE CONTROL OF DERMACENTOR VENUSTUS BANKS IN THE BITTER ROOT VALLEY, MONT., AND NEW DATA CONCERNING THE HABITS OF THE TICK[1]

By R. R. PARKER, *Bozeman, Mont.*

During the past sixteen years much time and money have been spent by various agencies, both medical and entomological, in the study of Rocky Mountain spotted fever, its mode of transmission, and the habits and means of control of the wood-tick, *Dermacentor venustus* Banks, the transmitting agent.

Medical science has been more interested in the etiology and pathology of the disease and the possibility of finding a cure, than in the actual control, though a few men have labored in this direction. Dr. S. B. Wolbach of Harvard Medical School, working since 1916, has suc-

[1] Contribution from the laboratory of the State Board of Entomology, Bozeman, Mont.

ceeded in demonstrating the causative agent, an organism which he considers to belong to a new group of disease agents, that is, it is neither bacterial nor protozoan. He has worked out the life history of the organism in some detail, and has recently named it. No cure, however, has yet been discovered. Four medical men have thus far lost their lives in this work, three through accidentally acquired infection. The most recent death was that of Dr. Arthur McCray, director of the State Hygienic Laboratory, during the past summer.

Entomological workers were early brought into the field by the apparent fact that the best hope of controlling the disease lay in the control of the tick which transmits it. The work was first taken up by Prof. R. A. Cooley, and later by the Federal Bureau of Entomology. The life history of the tick, and eradication measures were first worked out and actual control was initiated in 1912, the Public Health Service also coöperating.

The area of operation has gradually been extended until it now involves approximately 125,000 acres. The two federal agencies, however, withdrew in 1917, and since then the work has been carried on solely by the Montana State Board of Entomology. That control efforts have met with some measure of success is attested by the facts that considerable areas have been freed of ticks and, whereas up to twenty-five or more cases a season were the rule, during the past two years there has been but a single case in the area where the work has been conducted. The reduction in cases is attributable in part to the control work, in part to education to avoid infection, and perhaps in part to little understood natural factors. There is some reason to expect a slight increase in the number of cases during the next few years, especially in certain areas outside the control districts.

The work of control, however, is a long and tedious operation, alike to those in charge, and to the local farmers and others involved, and two questions persistently present themselves. One concerns the permanency of the results attained, the other the possibility of finding some simpler and quicker method of operation.

Permanency of results is especially to be desired, but knowledge on this point is limited by lack of knowledge of the real source of the disease among wild mammals, among which, there seems no reason to doubt, lies the real source of the disease. The question cannot, therefore, be satisfactorily answered. Questions of the susceptibility, immunity, chronic infectivity, habitat, periodical variations in abundance and distribution, and the seasonal migrations and habits of these animals are all intimately involved. Even though we may successfully eradicate the tick, it is possible that the real condition which is the very bed-rock of the trouble may be left behind. For example let us sup-

pose that a certain rodent is the medium through which the disease becomes endemic. Then, since the distribution of most rodents and their relative abundance is largely dependent upon the distribution of certain types of vegetation favorable to them, the value of the eradication of ticks and even of the particular rodent involved, is limited by the very probable facts that a certain degree of tick reinfestation is very possible and that since the natural habitat of the rodent remains, reinfestation by this rodent would also take place, with the possibility, at least, of a recurrence of the disease. On the other hand, if this rodent were known, or it might be that more than one species would be involved, steps could perhaps be taken to prevent its reappearance. In the case of certain rodents, such a course would be entirely possible and the probability of future tick reinfestation would be of negative importance.

At the present time, the methods of tick control employed are rodent destruction (directed particularly against the Columbian ground squirrel); the restriction of grazing; dipping and hand picking of stock; quarantine and cultivation. Under these measures, the minimum time to expect apparent results is three seasons, and complete eradication will take from five years on, depending upon the degree of coöperation obtained from the residents and the thoroughness with which the state can carry out its end of the control program. Hence, the chance that there may be some simpler means of solving the problem than those now in use is not only an inviting field for research, but also a very pertinent question at the present time, when there is the probability that it will be necessary to extend the work over a greatly increased area. This possibility immediately directs attention to the fact that methods of *tick control* depend upon local conditions, so that to secure the best results, variations in method, from place to place, are quite essential. The conditions which make such variations necessary are: differences in the hosts of the larval and nymphal ticks, differences in the hosts of adult ticks, differences in economic conditions, differences in the character of the vegetation and soil covering which predetermine the species and the relative abundance of the rodent hosts of the immature ticks, and finally differences in the habits of ticks, which often show considerable variation with short distances. Space does not permit that these factors be discussed, nor is it necessary, except to point out that a further expansion of the work would mean the working out of a system of control varied here and there, to adapt it to local conditions. This is a difficult thing to do, especially in a farming community. As an alternative is the possibility of finding a simpler way of checking the fever, that is, one of more general application. The latter step

has more to recommend it, and the writer believes that such a plan may be evolved by a study of disease among the wild animals, with the end in view, of eradicating from any area concerned, those rodents or other animals which permit the disease to perpetuate itself. Such an investigation has been carefully planned, and a mass of circumstantial evidence already at hand indicates the possibility that the rodents or other animals which it may be necessary to exterminate will be very few in number. If this be so, the work will eventually resolve itself into a systematic campaign against certain species of animals, and will be aimed at the actual source of the disease rather than at the control of the transmitting agent, a long process at best, desirable though it may be. Such a program would have much to recommend it over the present system of control,—it would be more rapid, more effective and less expensive; it would eliminate features of the present system which are a source of constant irritation to a certain class of residents, and under some conditions, the reduction of ticks would be fully as marked as under the present system.

Data Concerning Habits of Dermacentor venustus Banks

In spite of time which has been devoted to the study of the habits of the tick, the writer feels that knowledge of the latter is limited, and that additional study would reveal points of value. Our knowledge of larval and nymphal habits, in particular, is extremely meagre, and those of the adult tick are by no means well known or understood. The remainder of this paper, therefore, will be devoted to the presentation of a few points which the work of the past few seasons has brought out.

Tick Migration.—It has always been supposed that the movements of the adult spotted fever ticks were of very limited extent, but while carrying on studies in eastern Montana in 1917, conditions were encountered which led the writer to believe that such was not the case. Subsequent observations have confirmed this opinion. Conditions which first suggested the idea of tick migration were found in a hilly area, cut by narrow valleys from which still narrower much-branched coulees extended back into the hills on either side. The floors of the coulees varied from a few feet to several hundred feet in width, and in the middle was always a rather narrow draw which remained green and moist until late in the season. Each side of the floor gave way to a short and usually steep slope surmounted by sandstone rimrocks. Weathered rocks from the cliffs had accumulated at their bases and on the slopes below. In the clefts of the rimrocks and among the fallen rocks, deer mice, chipmunks, pack rats and cottontail rabbits,

the rodents which were found to be hosts of the larval and nymphal ticks, were found. Hence it would be supposed that this was the place the adult ticks would occur, and during the early spring months they were found in such places, in considerable numbers. In June, on the other hand, the ticks were scarce on the slopes, but abundant in the draw. At this time the slopes had become dry, but the draw at the bottom was moist, and the vegetation green and abundant. For example, in a certain coulee known as Wolf Den Coulee, which was about half a mile in length, the floor gradually narrowed from a width of about one hundred feet at its mouth, to a few feet at the upper end. On May 18, operations on the floor of the coulee failed to reveal any ticks, though they were found in abundance on the slopes at the blind end. On June 19, however, numerous ticks were "picked up" the whole length of the floor. In another coulee in which the draw was but from one to three feet wide, nearly two hundred ticks were secured in late June by dragging but a few hundred feet up the draw. Their absence here, and their abundance on the slopes above early in the season had been noted in previous operations. Similar conditions were encountered in widely separated localities. The improbability that the ticks had been dropped in these bottoms as engorged nymphs was shown by the fact that the hosts of the immature ticks inhabited not the draw, but the slopes above. The only reasonable explanation seemed to be that the ticks had gradually migrated downward, and concentrated in the bottoms. What the compelling factor was would be hard to say, though the possibility that they had migrated from the dry slopes to the moist bottoms was naturally suggested. The writer has met with similar movements in other localities however, when the moisture factor seemed to be absent. It is of interest to inquire as to what becomes of the ticks migrating to the bottoms. They were certainly not numerous there in the spring in which this work was conducted, but there is nothing to explain their absence, or to suggest that they might not have been numerous the following spring, except the fact that these draws are usually filled by rushing torrents in the early season, and very wet for some time thereafter. It is well known that this tick avoids wet places, and is not normally found there.

In 1918, when the writer took up the control work in the Bitter Root Valley, a few experiments were conducted, to see if migration actually occurred. For one experiment, a slope to the north of Big Creek near Victor, was selected. A certain trail on this slope had long been known to be heavily infested, the ticks always being found on the vegetation growing along the upper edge of the trail. Even before going to the Bitter Root Valley, my observations noted above had suggested the possibility that ticks migrated down the slope, and stopped when they

reached the trail. To prove or disprove this possibility, one hundred ticks, marked with white paint, were liberated one hundred feet above the trail on May 3, all at the same point. Unfortunately, it seemed, at the time, this whole area was burned over on May 4. One of my assistants, however, when going up the trail on May 23, found three of these marked ticks along the upper edge of the trail, these ticks having survived the fire and moved downward. The places were carefully marked, and we returned the next day, and again found the ticks, though they had changed their position up or down the trail. The two outermost were more than two hundred feet apart.

A similar experiment carried on in another place with two hundred ticks showed that a majority of ticks tend to migrate down a slope and that very few go up. Some, however, remained near the point of release during two successive seasons, 1918 and 1919. None were found more than twenty feet up the slope, nor more than two hundred and fifty feet down the slope.

The tendency of ticks to concentrate along a trail or road crossing a slope, or along the edge of cultivated land similarly situated has been observed in numerous instances, the details of which need not be recorded at this time.

As a further proof that these adult ticks move about, it may be mentioned that we often removed all the ticks from a tuft of grass on the edge of Big Creek trail, mentioned above, only to find it again infested on our next trip. The writer has also seen ticks drop from a grass blade or bush and deliberately move toward a person standing nearby.

Though the observations thus far made have only been of a preliminary nature, they have been sufficient to indicate that ticks do move about, and that the tendency when on a slope is to migrate downward, and that migration is hindered when the low vegetation is at all abundant. Under certain highly localized conditions, this fact has valuable application to control work. Other applications to the whole general problem may develop as a better knowledge is gained of the movements and the factors which control them.

A Reaction of Engorged Seeds to Light

Prof. R. A. Cooley determined some years ago that engorged immature ticks dropped from their host during daylight. During August of the past season, while feeding seed ticks on a cottontail rabbit, a chance observation developed the further fact that the rapidity of dropping could be increased or decreased by varying the degree of light intensity. By placing the infested animals in darkness dropping could be stopped, while by increasing the light intensity, the rate of dropping could be

increased, reaching its height when the animal was placed in direct sunlight.

This fact was determined in the following manner: A cottontail rabbit had been heavily infested with seeds. When they had become engorged and started to drop, a record was kept of the number dropped during each successive fifteen minute interval, the experiment having been originally started to determine at what time of day the majority of ticks dropped. After the count had been kept for several hours, it was noted that the intervals showed alternate high and low counts. The figures were too consistent to be due to chance, and an explanation was sought. The work was being conducted in a shed. The ticks, as they dropped, were being caught on two pieces of outing flannel used alternately. It was observed that one cloth was located in a patch of sunlight, which came through the shed door, the other in the shade. The high counts were from the cloth placed in the patch of sunlight. Varying the conditions from complete darkness to direct sunlight, it soon established the conclusions recorded above. It is probable that the same reaction to the intensity of light also determines the time of dropping of the engorged nymphs. In this connection a consideration of the habits of those rodents which are hosts of larval and nymphal ticks, and which are also susceptible to the disease, may be of value in understanding the distribution of infected ticks and to a certain extent of the fever itself. The factors which enter into this problem would be the time of day at which these host animals are active, that is, whether nocturnal or diurnal, the particular conditions as regards habitat under which the various periods of the day are spent, and the extent of movements when active and the character of country then sought.

Other habits of interest might well be mentioned but time has limited the discussion to those which have a possible bearing on the distribution of infected ticks and the consequent relationship to the occurrence of infection in human beings.

PRESIDENT W. C. O'KANE: This paper is now open for discussion.

MR. LEONARD HASEMAN: I would like to ask the speaker whether in any of his work he has found any other species of tick that carry fever?

MR. R. R. PARKER: I have not found other species myself, but other investigators working under laboratory conditions have found other species that carry fever. There are other species, such as the rabbit tick, which should be worked with to determine whether or not they carry the fever.

PRESIDENT W. C. O'KANE: If there is no further discussion, we will now listen to the paper entitled, "The Ecology of Certain Insects Which Infest Stored Food Products," by Royal N. Chapman.

THE ECOLOGY OF CERTAIN INSECTS WHICH INFEST STORED FOOD PRODUCTS

By R. N. CHAPMAN, *St. Paul, Minn.*

(Withdrawn for publication elsewhere)

PRESIDENT W. C. O'KANE: The next paper is, "The Extermination of the Pink Bollworm of Cotton in Texas," by Ernest E. Scholl.

MR. E. E. SCHOLL: I will read my paper first, and if there is time I will read the paper by Dr. Hunter on the same subject.

I was detained in Austin, Tex., before coming here, where I had a conference with Dr. Hunter.

PRESIDENT W. C. O'KANE: We have adopted a procedure by which if a man is not present to read his paper, it goes to the end of the session.

SECRETARY A. F. BURGESS: I would suggest in this case that the paper of Dr. Hunter be read, because it forms a part of a symposium on insect extermination, and if these papers are not all presented together, the subject will be presented in a very disconnected way.

The Association voted that Dr. Hunter's paper be read by Mr. Scholl.

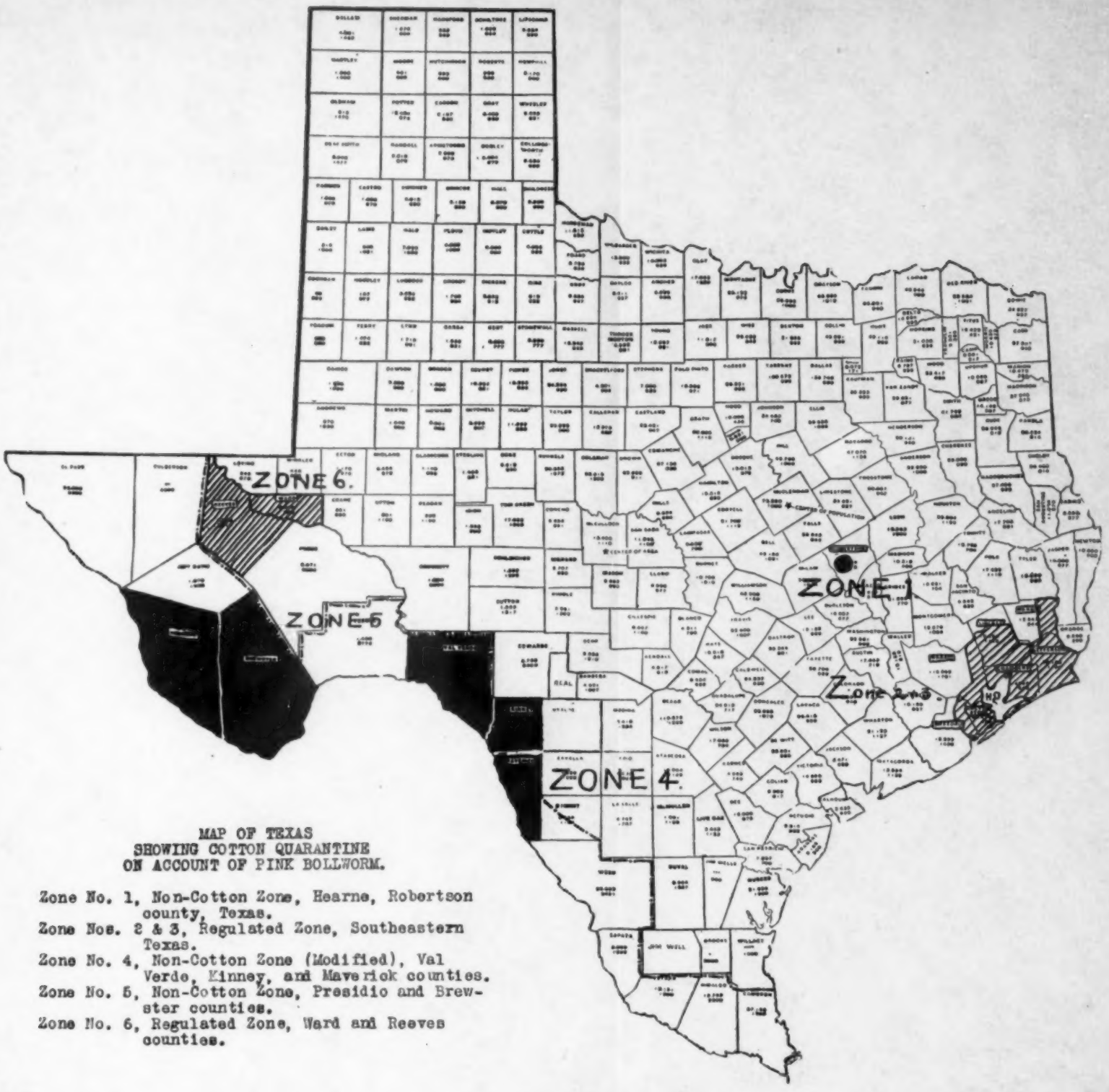
METHOD OF PROCEDURE IN PINK BOLLWORM ERADICATION WORK IN TEXAS

By ERNEST E. SCHOLL, *Chief Entomologist, State Department of Agriculture, Austin, Tex.*

According to the opinion of the writer, the best entomological legislation in the state of Texas was the placing upon the statutes of our state of the Pink Bollworm Act, passed in October, 1917, and improved by amendments in March of 1919 as House Bill 329 and now known as the Texas Pink Bollworm Act of 1919.

The Act is very specific, and although it deals with only one species of insect, it leads us to believe that in the near future the state of Texas, as well as other states, will use the act as a basis for the enactment of similar laws pertaining to other serious insect pests.

The provisions of the act are in the main two-fold. First, provisions are made for safeguarding against the introduction of the pink bollworm from Mexico. Second, portions of the law provide for strenuous measures in controlling and eradicating outbreaks of the pink bollworm that have already become established in the state.



MAP OF TEXAS
SHOWING COTTON QUARANTINE
ON ACCOUNT OF PINK BOLLWORM.

Zone No. 1, Non-Cotton Zone, Hearne, Robertson county, Texas.

Zone Nos. 2 & 3, Regulated Zone, Southeastern Texas.

Zone No. 4, Non-Cotton Zone (Modified), Val Verde, Kinney, and Maverick counties.

Zone No. 5, Non-Cotton Zone, Presidio and Brewster counties.

Zone No. 6, Regulated Zone, Ward and Reeves counties.

As a primary safeguard the legislature created a zone known by some as a "safety zone" and termed by others a "buffer zone," which consists of a tier of counties along the Rio Grande River, and provides for this safety strip of land in which it becomes necessary for the commissioner of agriculture to use special precautions in making inspections and surveys of cotton fields. Sections of the act following that portion which provides for the above zone makes it possible, under certain conditions, to safeguard the shipments of cotton products, and if necessary, prohibit the absolute growing of cotton. The procedure in establishing a non-cotton zone in this tier of counties consists mainly of the inspection of cotton fields in Mexico by federal men, and if pink bollworms are found within twenty-five miles of the Texas border such report, when received at Washington, D. C., is reported to the governor of our state by the secretary of agriculture, after which it becomes necessary for the commissioner of agriculture of Texas to verify the infestation. After this has been done and the report has been submitted to the governor of the state, he at once issues a proclamation creating a non-cotton zone consisting of such territory as may be deemed necessary to assure the prevention of the introduction of the pink bollworm into the state of Texas. It is under this section of the act that zone 4, consisting of the counties of Val Verde, Kinney and Maverick, has become a non-cotton zone since the spring of 1918 on account of the discovery of the pink bollworm at San Carlos, Mexico, about fourteen miles from the Rio Grande River, by federal officials in the fall of 1917, and verified by state officials in February of 1918. The present existence of the pink bollworm at San Carlos makes it necessary for the continuance of non-cotton zone No. 4.

Further steps are provided in the act for the commissioner of agriculture to prevent the shipping of cotton or cotton products from border zones, or to properly safeguard such shipments by fumigation before they are shipped.

The first steps necessary in the case of discovery of the pink bollworm within the state outside of the zone provided for in Section 1 are for the commissioner of agriculture, upon receipt of a sworn affidavit from an inspector to the effect that the worms have been found, to certify such fact to the governor, who then proclaims a special zone or quarantine district to such an extent as may be determined sufficient to prevent the spread of the pink bollworm, after which it is unlawful for any grower or any person to ship cotton products of any kind without special permission from the commissioner of agriculture. It is further provided that if in the judgment of the commissioner of agriculture the danger is of such nature that the cotton must be destroyed, such fact is also certified to the governor, who then proclaims such

cotton or fields of cotton a public menace, and authorizes the commissioner of agriculture to exercise his authority in complete destruction of such cotton or cotton plants. Immediately after the issuance of such proclamation steps are taken by state and federal officials in organizing clean-up gangs, whose work consists of the uprooting of all cotton plants and picking up of all waste cotton material and the destruction of all such plants and material by burning. Quarantines with these provisions were issued by the governor for zone 1 at Hearne in the spring of 1918; for zones 2 and 3 in the southeastern part of Texas in the spring of 1918, and for zones 5 and 6 in the western part of the state in the winter of 1918–19.

Should it become necessary for the commissioner of agriculture to destroy cotton fields in which considerable cotton is still unpicked, the act provides for the appointment of an appraisal committee by the county judge of the county in which the infestations exist.

This committee consists of three disinterested citizens, and their duty is to appraise, under oath, any cotton or cotton fields that must be destroyed. The appraisal report, approved by the county judge and certified to by the commissioner, upon the receipt of a certificate from the chief inspector in charge of the clean-up work that the fields and cotton have been destroyed, finally reaches the state comptroller whose duty it is to direct the State Treasurer to issue warrants to the growers for the amount due them on the cotton destroyed. Any grower who is not satisfied with the amount assessed by the appraisal committee has the right of appeal to any court of competent jurisdiction.

Unfortunately the state legislature did not set aside a specific sum of money by which such payments as called for above can be immediately paid. Steps are now being taken by the attorney general's department of the state with a view of having all such claims paid without legislative action.

The act also provides for the condemnation of cotton fields where a very light infestation of the pink bollworm exists. Under the provisions of this section the cotton is allowed to develop and is handled under specific directions of the commissioner of agriculture, is harvested under certain rules and regulations, and is marketed under restrictions. This section also provides that any extra services rendered by the grower of a condemned field in safeguarding the cotton is entitled to compensation by the state for such services. It is further provided that the commissioner of agriculture shall proclaim rules and regulations covering the thorough destruction of all plants and for the cleaning of ground upon which infested cotton has grown, such rules and regulations shall also consist of directions for shipping cer-

tain cotton products, and rules for growing and harvesting cotton in condemned fields.

The pink bollworm law further provides that if the commissioner of agriculture deems it necessary to the protection of the cotton industry of Texas that the growing of cotton in any quarantine district or part thereof be prohibited, he shall certify such fact to the governor, who thereupon declares the growing of cotton in such area a public menace and proclaims it unlawful to grow cotton in such district for the number of years specified in the recommendation of the Pink Bollworm Commission. It makes it necessary for the commissioner to inspect such area after each crop season and have additional commission hearings for the purpose of continuing a non-cotton zone or changing the same to a regulated zone.

A section of the act provides for the proclaiming by the governor of a regulated zone in which it is permissible to grow cotton under rules and regulations by the commissioner of agriculture, embracing the planting of cotton seed from non-infested territory, beginning within the zone, marketing, and such other rules as may be deemed essential. The regulations also include the destruction of cotton fields which may be found infested in regulated zones, and provisions are made for compensation to the grower for such cotton destroyed. Compensation is not allowed, however, to any person or persons violating the proclamations, rules and regulations. Steps under this act were taken early in the spring of 1919, when it was recommended by the Pink Bollworm Commission, after holding a public hearing at Houston on April 18, 1919, that the original non-cotton zone 2 and 3 should be changed to a regulated zone. This was done by proclamation of the governor and the work of growing cotton has been supervised by state and federal officials. Pink bollworms were again found in this territory in the fall of 1919, and the cotton is now being destroyed after having been appraised by proper committees.

The act provides that the commissioner of agriculture and his authorized agents shall have the power to enter into any field or fields of cotton or upon any premises in which it may be necessary to enforce the provisions of the act. It is also provided that the commissioner of agriculture of Texas shall coöperate with the secretary of agriculture of the United States in any measures authorized and to be undertaken in preventing the introduction of the pink bollworm into the United States through the state of Texas. It has been fortunate for Texas that this clause has been inserted in the law, because of the fact that the federal government came to our rescue with men and with funds when under the circumstances the state itself could not have con-

trolled and checked the heavy infestations of pink bollworms that were found in the state in 1917 and 1918.

In the penalty clause of the act heavy fines are assessed for not reporting the presence of pink bollworms in cotton fields and for the violation of provisions of any proclamation, rules and regulations.

In the act of 1917 the placing of a certain limited quarantine or non-cotton zone was left almost entirely with the commissioner of agriculture and the governor. This created considerable dissatisfaction and the law of 1919 was so amended that it now carries a provision by which a Pink Bollworm Commission consisting of five entomologists, one designated by the governor of the state; one appointed by the State Department of Agriculture; one by the A. and M. College of the state; one by the Federal Department of Agriculture; and one appointed by the county judge in which the infestation occurs, which commission must, after having received certified reports of infestation, make investigations of such reported infestation; hold public hearings in or near the infested area and recommend to the commissioner of agriculture the nature of quarantine (non-cotton zone or regulated zone) which shall be promulgated and proclaimed by the governor. The area to be quarantined shall not exceed a distance of five miles from the outermost known infested field.

The Pink Bollworm Commission held a public hearing at Marfa, March 27, 1919, and recommended non-cotton zone No. 5 consisting of the counties of Presidio and Brewster.

A meeting was held at Pecos by the commission on March 29, 1919, and it was recommended that the infested areas at Barstow and Pecos in the counties of Ward and Reeves be placed in a regulated zone.

A hearing at Hearne, Tex., by the commission on April 17, 1919, recommended the continuing of non-cotton zone No. 1, and a final hearing at Hearne on October 15, 1919, recommended the reduction of non-cotton zone No. 1 to the city limits of Hearne, Tex.

The commission held a public hearing at Houston, Tex., on April 18, 1919, and recommended the changing of non-cotton zones 2 and 3 to a regulated zone for the season of 1919.

The commission as it now stands consists of the following members: Dr. W. D. Hunter of the federal government; Ernest E. Scholl of the State Department of Agriculture; Prof. S. W. Bilsing of the Texas A. and M. College; Mr. K. M. Trigg, planter of Bastrop, representing the governor of the state.

The county members are now being appointed for hearings at Houston, Tex., on January 6, 1920, with reference to the new infestations

in zones 2 and 3; at Eagle Pass on January 8 on zone No. 4; and at Marfa, January 10, on zone No. 5.

As further provided by law the inspection affidavits, as well as the commission reports are filed in the office of the commissioner of agriculture at Austin, Tex., where they are open to inspection by the public.

The act further provides that the commissioner of agriculture shall make adequate investigation with reference to the presence of the pink bollworm in the state and shall take prompt action to secure and maintain quarantines. For the purpose of enforcing these provisions, the commissioner may employ and prescribe such inspectors as may be necessary, and fix their compensation. An appropriation is provided for the payment of these inspectors in the services made necessary to enforce the act.

Besides the emergency clause there is a section providing that the several sections of the act shall be construed as cumulative in effect, and shall not be held to modify the provisions and restrictions or requirements of other sections. If any provisions of the act shall be declared unconstitutional, such fact shall not operate to invalidate other provisions.

In a number of test cases this act has been ruled by proper legal authority to be constitutional, and it is the opinion of the writer that under its provisions, and with the aid of the federal government, it will be possible to absolutely exterminate the pink bollworm in the state of Texas, and to prevent new infestations coming in from Mexico.

The following data will give the readers a general idea as to the location of each pink bollworm quarantine area in the state of Texas and the exact area of each of the zones:

PINK BOLLWORM QUARANTINE PROCLAMATIONS IN TEXAS

Original quarantine proclamation, zones 1 and 2	1/21/18
Quarantine proclamation, zone 4	2/19/18
Quarantine adding territory to zone 2	2/25/18
Original non-cotton proclamation, zones 1, 2, 3	2/25/18
Proclamation changing Hardin County line	3/21/18
Final quarantine proclamation	5 /7/18
Quarantine proclamation, zone 4	4 /9/19
Quarantine proclamation, zone 5	4 /9/19
Quarantine proclamation, zone 6	4 /9/19
Hearne quarantine proclamation	4/24/19
Hearne non-cotton zone No. 1	4/24/19
Regulated zone 2 and 3 proclamation	4/24/19
Regulated zones 6A and 6B	5 /1/19
Proclamation reducing zone No. 1	Oct. 19

AREAS IN TEXAS AFFECTED BY THE PINK BOLLWORM OF COTTON

Area in regulated zones 2 and 3:		
¼ of Brazoria County	476 square miles	304,640 acres
Chambers County	648 " "	414,720 "
Galveston County	438 " "	280,320 "
¾ of Hardin County	281 " "	179,840 "
¼ of Harris County	352 " "	225,280 "
Jefferson County	1,109 " "	709,760 "
½ of Liberty County	581 " "	371,840 "
Total zones 2 and 3	3,886 " "	2,487,400 "
Area in regulated zones 6A and 6B:		
Reeves County	2,610 square miles	1,670,400 acres
Ward County	858 " "	557,120 "
Total area zones 6A and 6B	3,468 " "	2,227,520 "
Total area zones 2 and 3	3,886 " "	2,487,400 "
Total in regulated zones	7,354 " "	4,714,920 "
Area in Robertson County non-cotton zone:		
About	25 square miles or 10,000 acres	
Area in west Texas non-cotton zones:		
Zone No. 4:		
Kinney County	1,269 square miles	812,160 acres
Maverick County	1,332 " "	852,480 "
Val Verde County	3,034 " "	1,941,760 "
Zone No. 5:		
Brewster County	5,006 square miles	3,203,840 acres
Presidio County	2,652 " "	1,697,280 "
Total area in non-cotton zones	13,293 " "	8,517,520 "
Grand total area affected	20,647 " "	13,232,440 "

THE EXTERMINATION OF THE PINK BOLL WORM IN TEXAS

By W. D. HUNTER, *Washington, D. C.*

(Withdrawn for publication elsewhere)

At the conclusion of these papers, First Vice-President Ruggles took the chair.

VICE-PRESIDENT RUGGLES: The time has now arrived for the Presidential Address, which will be delivered by Professor W. C. O'Kane.

THE DAY'S WORK

THE OPPORTUNITY OF THE DAILY CONTACTS IN THE LIFE OF A SCIENTIFIC WORKER

By W. C. O'KANE, *Durham, N. H.*

When a boy has reached the age of six and is ready to enter school we commonly look on that occasion as the momentous beginning of his

education. He is now to begin with books and to acquire knowledge. "You are going to study, now," we say, "and to learn."

"To learn what?"

"Why, to learn many things; spelling and reading, addition and subtraction, all about the different countries and about history, and many other interesting things."

Thus is the great process started and thus it proceeds. As the years pass these matters expand and sub-divide. Arithmetic becomes algebra and geometry, geography grows into political economy. In due time these foundational studies are succeeded by the specialized subjects of college and graduate work. Presently, the round finished, the last laboratory period at an end and the thesis typed and bound, our young man enters his profession and takes up the daily life of a scientific worker. He has completed his equipment.

This accoutrement of formal knowledge is what we usually mean when we mention the training possessed by a graduate ready to undertake a position. Naturally, it is the acquisition that our young man treasures as his principal qualification for the successful pursuit of his calling. Often, in combination with our particular record of experience, it is the measure by which those of us who are no longer beginners take stock of our possibilities in speculations on professional advancement.

Now it would be idle to minimize the value and significance of fundamental and specialized knowledge in the training and equipment of the scientific worker. We all recognize its importance. Nothing else can take its place. Without it there can be no constructive planning of a life of scientific work. It is the string to the bow.

But we shall be foolish if we think of this phase of equipment as the sole or even the major factor that has to do with advancement in a scientific career. It is but one of several. It is indeed one of the hinges on which may swing wide the door to success in life's work. Perhaps it is the top-most hinge. But unless the others that rightly belong there are in place, skillfully made, well-fitted and properly oiled, the door will sag and will never open wide to the full and glorious vision that lies beyond.

The scientific worker, like any other normal person, wishes to succeed in his work. But how shall we define success?

If in our definition we propose to lay hands on concrete and specific terms, no man may define success, except as it applies to him and to him alone—and not even then unless he is more skillful in analysis of his own personality and more deeply aware of the inner meaning of his surroundings than most of us can ever hope to be. For no two men

ever seek the same combination of ultimate ends or propose to arrive at them by precisely the same means.

Yet, we may safely assert that for everyone life is a constant striving toward some goal. No one may escape this effort. It persists through every conscious hour, through every month and every year, so long as life lasts. The particular end for which the individual spends his effort may be noble or base, generous or selfish, physical or mental, fleeting or permanent. It may involve the sweet or the bitter in its attainment. But a striving for it exists always.

We may rightly say, too, that for each individual the day's work holds out some measure of attainment of the object of his effort. This measure may be little or great. Its sum at the end may be tragically small; it may sometimes be unfortunately large. Happily it may be such measure of attainment as to fulfill a well-balanced ideal of a well-rounded life.

Since we do strive, inevitably, and since we do attain, inexorably, may we not define success for the scientist, as for any other thinking being, as a reasonable attainment of worth-while objects of effort.

In reaching this attainment the course of life follows no broad highway. For each individual it is a devious path, winding its way amid constantly varying surroundings, crossing and re-crossing a thousand other paths. He who travels the path must find himself always in varying contact with the physical world about him and with the other human beings who people that world. In his course he must reckon also on the physical, mental and moral makeup that constitute his own person and personality.

It is true of all living things that daily life is a succession of contacts. Its orderly program is a series of adjustments to these contacts and to the conditions and circumstances that they carry with them. For all animals except man the nature of the adjustment is fixed. It involves a problem only in a wide and general sense, not in an individual and specific way. The reaction to a given situation must be speedy, automatic and effective. If it were not, it would not have persisted.

Some such simple arrangement must have prevailed for human beings also in the ages long ago. But with the ability to think and to plan, to alter and control our physical surroundings, and in doing so to unite with others in common effort, there has come to us, as a part of our heritage, a vast and increasing complexity of adjustment. Conditions that were simple have become many-sided problems involving infinite mental and moral checks and balances. Daily life, which was once a well-charted course, has become an intricate study.

In speaking of adjustment the word must not be misconstrued. It

implies recognition of circumstance, but it ought never mean surrender or subservience. The history of mankind is too crowded with the records of victory over difficulty to recognize any doctrine of retreat. Hueber, a scientist with sightless eyes, Beethoven, a great composer living in a soundless world—these and a multitude of others deny the existence of defeat.

In this problem the scientific worker today shares in marked degree. If, for a moment, we may place ourselves at a distance from the typical day's work of the scientist, in order that we may compare it with the round of duties of other men, we shall find that it is not set to a certain program as is that of a great number of people about us. For others the routine of the day is fixed. The procedure to follow is settled. The job is standardized. Nothing of that sort is or should be true of the scientific worker. His very freedom itself complicates his task. The manner of his work he may alter if he desires. Furthermore, his life is lived in a world within a world. He has a double adjustment to make because of contact with fellow workers in faculty or department and a quite different contact with the remaining people of his community. The very subject matter that constitutes the basis of his life's task is in a constant state of change and growth. Steel is not steel in his day's task; wood is not wood. The material he works with today has changed by tomorrow. Because he is earning his living with his brains he is apt to forget about his body. A multitude of his daily adjustments must be intangible. Their properties and bounds may not be held up before the eye but are invisible, fleeting. Yet, just for these reasons it is vital that the scientist should be making these adjustments with skill, understanding and foresight. They are worth his study.

With few exceptions scientific workers are employees of some institution or bureau whose function it is to bring together men in the same or related lines of work. Our daily associates, therefore, are for the most part men who are engaged in work similar to our own. Their aspirations are brother to ours. Their gifts and failings are our own. Whatever tendency to prejudice girdles them about pulls equally at us. The circumstance that gets on their nerves gets on ours. And so, too close contact of like substances occasionally sets up friction, in the heat of which some of our best possibilities are apt to boil away in useless vapor.

Now it is obvious that we all desire the buoyant help that comes from the well-founded admiration and respect of our associates. There is no stronger incentive to good work than that. We crave and need the well-earned approval, confidence and liking of our co-workers.

Yet it is a law of human contact, long since proved by experience and deeply rooted in the makeup of all of us, that we get from our neighbors what we give to them. Think of them as what they are—able men and women doing good work—and they will soon think of us in the same way. Realize that they are living out their lives in their own way, as is their right, and that our failure to see their good work is due to the glasses that we have placed before our eyes. It would not be well that all kinds of human excellence should be alike.

"Men," said Dr. Holmes in *The Autocrat*, "often remind me of pears in their way of coming to maturity. Some are ripe at twenty. Some come into their perfect condition late. And some, that have been hard and uninviting until all the rest have had their season, get their glow and perfume long after the frost and snow have done their worst with the orchards. Beware of rash criticisms; the rough and astringent fruit you condemn may be an autumn or a winter pear. . . . "

In the relation between ourselves as members of a staff and the officers of administration to whom we are responsible there should exist a thorough understanding, carefully and thoughtfully maintained. On our part, as employees, it will be helpful to remember that in the various problems that arise involving adjustment between ourselves and administrative needs we are quite likely not to know the whole facts of the case. If we knew them probably our views of the matter would be altered. It is a very human and very universal failing to form opinions on insufficient data. We all do it. Most of us have had the experience of discovering, at a late date in a discussion, facts that we did not suspect and that, once known, altered our judgment. We cannot see all around from a position down below. The point of view from which complete vision is available is at the top.

Turning the question the other way about, if we ourselves have administrative functions we shall strengthen the efforts of our associates and assistants if we will bear in mind the clarifying effect of complete information. Men cannot read one another's thoughts. And since they must come into intimate contact and must base their acts, in ever-increasing degree, on the plans and purposes of others, a frank discussion beforehand is a worth-while help and safeguard.

In this same direction it is to be hoped that the process of organizing going on within our various bureaus and institutions may not proceed to the point where forms and formalism displace personal contact and understanding. The thing seems to be like some plant that has escaped from cultivation: a useful species to indicate a border or a path but a nuisance and an obstruction when it gets out of bounds. One is reminded of the words of Mr. Britling, where he says, "All organization, with its implication of finality, is death. Organized morals

or organized religion or organized thought are dead morals and dead religion and dead thought. Yet some organization you must have. Organization is like killing cattle; if you don't kill some the herd is just waste. But you mustn't kill all or you kill the herd."

For most scientific workers it must appear that the ordinary day is filled with a multitude of minor duties. Routine of some sort absorbs an extraordinary proportion of our time. In the midst of this it is difficult to see how we may find opportunity for thoughtful and constructive adjustment. This round of routine is apt to grow more extensive and exacting as the scientist advances in professional rank

In the midst of this distraction it is well to realize that any man, in any pursuit whatever, finds a multitude of details that must be done in order to carry forward his work. Even in purely creative work, in writing or painting, there is a necessary routine that will astonish one who has not observed such work in the making. Doubtless it would impress us as drudgery to spend weeks in study of a set of blank walls, yet that was a part of the process by which Michelangelo executed his great frescoes. We are charmed by the beauty and vivid detail in the novels of Scott, but we find that he spent many days in intimate study of the topography, botany and geology of a locality before he used it as the setting for one of his incomparable scenes.

All of these details were necessary means to an end. In no other way could that end be achieved. And because they were necessary they were a part of that end. They helped to bring about the consummation of an ideal. In so doing they, themselves, became a part of that ideal in just the same essential degree that the foundations of a building, deep beneath the ground, are an essential part of the final structure.

So, in the routine of our work as scientists, details have their part in building toward an ultimate ideal. Without the interest of that ideal they are so many bricks and so much mortar, heavy to handle, dreary to contemplate and devoid of any attractions. But from these materials we may, if we will, build structures whose service and beauty are limited only by our capacity and enthusiasm.

A purpose, then, is the alchemist which can transform a day's drudgery into a day's progress. If it should be that interest itself is fundamentally lacking for any of us, then there must be a misfit somewhere and if there is a misfit there must be a change. A change may be of two sorts. In rare instances the circumstances may be such that a change of occupation is really the only way out of a difficulty. But usually it is not that which is needed. It is a subjective question rather than an objective. The alteration required is in our own viewpoint rather than the thing viewed.

It is a happy truth of psychology that interest tends strongly to follow close on the heels of purposeful work. Throw your energy into a task and the task itself speedily acquires a surprising interest. Assume the attitude of enthusiasm and presently enthusiasm follows. But sit down and look askance at a duty, thinking what a dreary round it is, and interest will shy away beyond reach or ken. Contemplate the job long enough in this fashion and by and by the job itself will become impossible.

It is a further reassuring law of psychology that wherever interest exists there will be found some measure of innate ability. If we find that we can instill interest into the day's routine we may be sure, also, that there lies within us the power to build out of that routine an attainment worth while. In so doing we shall inevitably find pleasure in the work. For there is no other pleasure possible to a human being that can equal the satisfaction of carrying through a worth-while task to successful conclusion.

If, as we contemplate our ordinary daily routine, it appears that much of it fails to lead us anywhere, may we not look on that fact itself as a problem of surpassing interest. When we have given it study as such, we shall certainly find a way to improve conditions. In so far as we may exercise a choice it will be worth our while to single out for more sustained effort the parts of our day's work that are permanent and worth while. Many of us must have been surprised to discover at times that under necessity we could carry through an effective day's work in a half day's time. It would be foolish to attempt this at the expense of needed recreation, rest, and study. Nevertheless, there is something of suggestion in the experience. Success in life is not so much a matter of exceptional brains as a question of the habitual daily program.

A human being is fortunate that has the privilege of following out some line of investigation as a part of his normal duties. A scientific problem is to the mind precisely what physical exercise is to the body: both an incentive to effort and a means of increasing the power for such effort. Granted that we have opportunity for investigational study—and all of us should have it in some fashion or other—we may rightly expect from these duties the increased mental efficiency that is certain to follow their performance. A scientific worker, if his daily task is well conducted, must learn how to think.

Now thinking is not a continuous process in the human race—including ourselves. A very great part of our activities are automatic. We arise in the morning, dress, eat breakfast, look through a morning newspaper, ride to the office, open our mail. Friends or associates arrive and we converse with them on various topics. We hear classes, mark

papers, sign reports. Presently it is evening and the day is done. In the course of this we have, occasionally, done some real thinking. But it has not been so continuous or so deep as to strain our mental faculties.

The scientist, in the investigational phase of his day's work, must learn to do better than this if he is to stand in good repute. The road by which he may surely arrive at scientific truth bears little resemblance to the sketchy path ordinarily followed in reaching conclusions, even his own, outside of science. People in general do not actually think out statements of fact. Select ten newspapers. Toss a statement through them to ten hundred thousand readers. It will be gulped down promptly and completely, like so much breakfast food. We all do it. Start a rumor and you can watch it grow into fact before your astonished eyes. Not all people impose thus on themselves all of the time, but some of them do it all of the time and all of us do it some of the time. If, in addition, the supposed facts are fed on sentiment their health and strength are doubly assured. Falsehoods swallowed as facts are causing acute indigestion in the labor world today. In the words of Josh Billings, "Tain't what men don't know that makes trouble in the world; it's what they know for sartan that ain't so."

Even experience seldom furnishes complete and reliable data. It may readily afford isolated facts but the causes of those facts may remain totally obscure or completely misinterpreted. The observations that make up experience usually lack the precision that is a necessity in genuine scientific work. They are not planned to secure continuity. They are not marked by that freedom from personal bias which is essential in a clear-cut search for truth. The observer has seldom the foundation of apperceptive data in the light of which alone can findings be properly weighed and measured. On the contrary, related facts are likely to be faulty. A king of England, a good enough king, once asked the Royal Society to investigate the reason why, when you place a live fish in a bucket of water, you do not thereby increase the weight of the vessel of water. The members of the society replied by correcting the fact.

All of which serves to point out the mental stimulation that is a happy by-product of investigational studies. Real thinking may be somewhat unusual, but it is quite an available process, in the exercise of which one's mind is inevitably quickened. The methods of research are good standards to carry over into other phases of daily life.

Consciously or unconsciously we follow a rather definite procedure in every piece of genuine investigational study. It begins with the stimulus of an unsolved problem. Thence it proceeds through successive orderly steps which include the isolation of a specific question

for study, the collecting of experimental data, the formulation of hypotheses, the trial of these while withholding judgment and finally the proposal of a conclusion which we have found to stand trial and test. There is much of interest and suggestion in these steps.

The stage by which we recognize the existence of a problem is presumably automatic. It is automatic because there are so many unanswered questions to perplex daily life. Some of these are bound to press upon our consciousness, clamoring for solution. We are not aware of all of them for the reason that we have grown accustomed to accepting many things as they are.

Out of the multitude we select a specific question to which our energies shall be devoted. This essential preliminary step is not always easily accomplished. Various questions are complexly interrelated. We must unravel some of these intricacies. We must pare our subject here and there, in order to reduce it to usable size.

Then begins the step of collecting data. We are now to set ourselves patiently to observe facts and to record them. But that is not all. The facts must constantly be observed in the light of their possible relationship, for the ultimate object of our inquiry is a matter of causes and, therefore, of principles and laws. Mentally, we have in this a somewhat delicate balance to maintain, for we must be painstakingly accurate yet must not become wrapped up in detail to the exclusion of wider truths, we must demand that which is concrete and specific while searching for that which is abstract and generic, we must be skeptical yet possessed of an open mind. Neucomen was searching for truth and demanding fact as he went about his study of the steam engine. But his open mind flashed to him an interpretation when his apparatus performed in unexpected manner, and the result was the principle of condensation by means of a jet.

In the light of our accumulated data we propose our tentative theories and in this we shall need all that we possess of constructive, resourceful imagination. Sometimes we speak of imagination as if it were a handicap to a scientific worker, a faculty to be sternly repressed and stifled. There could be no greater error. A well-ordered power of conjecture is a precious attribute. Observation alone is not sufficient. Facts by themselves do not disclose relationships. All of the observable facts in the world, unillumined by imagination, would never have disclosed the causes of insect fluctuations, the laws of the procession of the planets or the possibility of liquid hydrogen. Only when winged by conjecture, can the mind cross the void from fact to relationship. "The imagination," said President Eliot, "is the greatest of human powers, no matter in what field it works—in art or literature, in mechanical invention, in science, government, commerce or religion;

and the training of the imagination is, therefore, far the most important part of education. . . . Constructive imagination is the great power of the poet, as well as of the artist, and the nineteenth century has convinced us that it is also the great power of the man of science, the investigator, and the natural philosopher."

While the process of accumulating data is proceeding it is helpful to stop sometimes with the deliberate intent of withdrawing a sufficient distance from the object of inquiry to see it in perspective and to discover if its newly-ground facets may not catch some light from its surroundings. In the laboratory notes of Faraday are these words: "Nothing is too wonderful to be true if it be consistent with the laws of nature. Let us encourage ourselves by a little more imagination prior to experiment. Let the imagination go, guarding it by judgment and principle, holding it in and directing it by experiment."

And finally, in the course of investigation, we find ourselves practising that rarest of mental acts, suspension of judgment while our theories are standing the trial of deliberate test. It is a fine training. Men do not usually withhold their opinions in that fashion. Suspense is unpleasant to the human makeup. Continue the suspense long enough and there is relief in the drawing of a conclusion however hasty and ill-considered. Wrap the mental makeup in the mantle of likes and dislikes, prejudice, desire or habit, and deliberately suspended judgment becomes rare, indeed. To practice it is good discipline.

And so, in following out these processes in the course of his daily work, the scientist may rightly feel the satisfaction that comes from doing worth-while things in a worth-while way and may readily find for himself the interest that goes with a program of exploration and adventure. There is no visible limit to the field. For every truth that was dug out of the darkness in the course of the nineteenth century, a hundred have seen the light in the twentieth. No one has ever reached the horizon of scientific work. As new rooms are added to the great edifice of science there are new, dim corners to be explored.

Nor may we assume that all that we commonly accept now is necessarily true. Acceptance is not finality, even in the face of abundant proof. The earth was known to be the center of the universe until Gallileo and Copernicus discovered otherwise. Not many generations have elapsed since a professor in Harvard University proved that to telegraph to Europe beneath the ocean was impossible.

In the classroom duties that fall to the lot of many of us there are extremes of contrast. The work may be made a dreary routine of boredom or it may be enlivening, interesting, inspiring. You will readily find examples of each.

The teacher is a good deal like a gardener. There are plants of various characteristics filling the garden. Individually, they are what they are, so far as species is concerned. The gardener cannot change that. He cannot bring them plant food to be injected into them and thereby change their makeup. But he can shape their growth and can profoundly influence their final form and utility. In accomplishing this he must hoe and rake and lug water. If he thinks of these tasks as sheer, purposeless routine, his garden will suffer and he, himself, will lead a dreary existence. If he considers his plants as living things, whose possibilities he will deeply influence, his daily task is illumined and refreshed.

Why are students taking the courses that we offer in college? What are the purposes of college training? It may not be amiss to consider them, for they are not always clear in the dim light that sometimes pervades college classrooms.

Undeniably one of the purposes of any college course is to increase the students' store of usable facts. From much of the curriculum we might infer that this is the only important purpose in going to college. It is not so. But, frankly, it is a real purpose, an honest one. It is not so much a case of storing facts that shall in after years be promptly recalled on request, like so many cartridges stored in a mental magazine, each ready to go off on demand. The wider and deeper aim is to increase the range of acquaintance of the mind, to give it a subconscious foundation for a purposeful structure that is to come later. Facts form a necessary apperceptive basis. They are bridges leading in many directions. They furnish for the living room of the mind a sort of indirect lighting that illuminates shadows and enables future work to go forward smoothly. So the storing up of facts is a proper purpose.

But facts are interesting in their relationships. They lead by induction to principles. Whereas facts are limited and exclusive, laws and principles are limitless and inclusive. Facts are the minute pieces of a mosaic. Principles are the pattern. A knowledge, then, of principles and laws is a further purpose of college training.

These things, facts and principles, are external. But it is the purpose of a college education to train the student to think for himself; to make his own observation of facts; to draw his own safe and sound conclusions. In the words of Coleridge, "to educate is to train to think, for by active thinking alone is knowledge attained." In the exercise of this function the student is to construct his life's program of activity. And so it is a third function of college training to help the student to realize his best possibilities in his life work.

Yet, even this is not the summit of college aims. We should be doing

our task poorly and incompletely if we thought only of facts and laws and their utilization in efficient mental process. A college has failed unless it has given to its young men and women a wider vision of life itself, has pushed back the horizon, has served to give new meaning and value to the things which make up life. "The purpose of education," said Spencer, "is to prepare for complete living."

The method, the technique, by which the instructor may best seek to further these purposes has never been well studied and defined in the realm of college teaching. There is no comprehensive fund of recorded experience on which we may draw. In meetings of college faculties our time seems rather to be occupied with discussion of proposed new courses, re-arrangement of those that exist and discourse concerning student absences, grades and petitions. There appears to be a sort of general theory that a college student is mature and fixed in his mental processes. It seems to be sufficient if the instructor enunciate a multitude of facts. And, in truth, probably the instructor is doing as he was done by.

But the psychology of learning does not cease with the grammar grades. Indeed, in the great fundamentals, there is probably little difference between the learning processes of the high school student and those of the college student. In the secondary schools the question of teaching methods has received much study. There is no reason to confine to the high school many of the principles now recognized and accepted. Read again that lucid volume by William James entitled "Talks to Teachers," and consider if the suggestions there made do not apply to all teaching.

In our college classes, as in the grades, we shall do well if we take pains to lead our students from the familiar to the unfamiliar and not plump them into the wholly new without anchor or compass. The store of experience and knowledge that a student already possesses is his only possible basis for understanding and interpreting new facts. The bridge from the unknown to the known cannot span great gulfs at a single leap, but must arch from pier to pier. The new thing that has a discernible relation to something already familiar is armed at the outset with interest.

Again it will best avail our purposes if we constantly let the simple precede the complex, the concrete precede the abstract. To proceed from principle to example, even though the principle may be expressed in few words and the example require many, is to run contrary to the normal process of the human brain. A law is simple to us as teachers because we have had experience with many illustrations of it, but to the student who lacks this apperceptive data the law is complex.

We need not be ashamed of constant and constructive effort to

arouse and maintain interest in our classes. "Interest," said Joseph Cook, "is the mother of attention, and attention the mother of memory; if you would secure memory you must first catch the mother and the grandmother." If we would be certain of intelligent interest from the beginning we must make sure that the bearing of our particular study on college training in general is understood by our students. Certainly there is a reason why we propose to ask their time and attention. If there is none we'd better do something else. But the real relation of that particular study to the student's equipment may be quite obscure and its bearing once revealed may be an agreeable surprise.

Throughout all of our contacts in teaching we shall greatly help ourselves and our work if we thoughtfully cultivate a sympathetic understanding of the student's point of view. It is not the same as ours. The scale by which he measures the importance of life's events is different from ours. In any life such a scale is constantly changing. Our own has materially altered and will keep on changing so long as we live. We are apt to forget that and thereby to misjudge a student's exuberant interest in fraternities, sports and kindred affairs. Those things are his own. They are absorbingly interesting. If we permit our classes to be dull can we wholly blame him for his choice?

In any of the contacts into which the winding path of the day's work may lead us, we, ourselves, form half of the bargain. Adjustment then must always be as much concerned with the person that travels the path as with the path itself and its other travelers.

In this purely subjective side there can be no doubt as to what factor ranks first. A good many years ago a man named Paul, in a letter to the people of Corinth, spoke reverently but sternly of the human body as a temple. For thousands of years before that and through every year since, the admonition has been constantly repeated. It must be confessed that we need it.

The fact that we as scientists are engaged in work of a mental character may make the way easy to imperfect health, but it in no wise makes that physical state allowable. On the contrary, because of its mental product, our machinery for the day's work is the more easily rendered inefficient. No mental process takes place without a corresponding physiological output. We drive our team of body and mind with a single pair of reins. As we direct the one, so goes the other.

In speaking of health we mean today more than freedom from obvious bodily impairment. There is a state of health much higher than that, a physical trim, a complete well-being in which one's poise is perfect and alert, one's energy instantly ready, one's reserve full

and complete. Such physical fitness promptly carries over into the mental world. It clarifies judgment. It eliminates boredom from routine. It establishes confidence. It carries its possessor forward to an undreamed-of realization of his own possibilities. It makes us pleasanter people to live with.

Few of us possess real physical fitness. Of the thousands of men who have been examined by the Life Extension Institute,—most of them men of exceptional intelligence and training,—an astonishing percentage are found to be physically impaired. Usually these men did not know of their impairment or that they could readily, in most cases, attain a degree of health and efficiency hitherto unguessed.

It has been easy to slip into ways that reduce physical vigor in these modern days of highly organized mental and economic life. The grandfathers of most of us had to be physically active. On the whole they probably lived a more normal physical existence than most of us enjoy. There is no essential harm in present-day strenuous living if we order it thoughtfully. But we must think about it. We can avoid subjecting ourselves to senseless hurry, to unnecessary eye strain, to ill-considered diet, to worries carried home. We can work, play and sleep in the rejuvenating oxidation of fresh air.

None of us ought to permit himself to finish the day's work with reserve energy materially depleted. Fatigue is not local. When any part of us grows tired our blood stream carries the poison to other parts of our body; we cannot overwork one part without feeling the ill effects elsewhere. It is helpful to remember this, because physiologists have come to have a new conception of the importance of brief and frequent relaxation as a means of maintaining one's store of reserve energy. We shall work better if we deliberately seek it.

We need occasional long vacations. There is no other way in which to get a renewed and freshened outlook on our work and to clarify our appreciation of life's values. Keeping one's nose to the grindstone is neither the proper place for the nose nor a suitable occupation for the grindstone. "There is nothing," said Stevenson, "so much a man's business as his amusements." If we stay close to our work long enough and steadily enough, we come to believe, after a time, that the work would collapse without our help. Eminent statesmen in our own recollection have illustrated this phenomenon. We get into a habit of daily routine which unconsciously we dislike to break. We need the change but we shy from it. There is no surer proof that a new set of surroundings and a new viewpoint will be wholesome for us.

Even without waiting for a vacation period we may find great help in restoring to our daily round something of the physical activity that

our ancestry proves that we need. Walking twice a day two or three blocks to one's office is not following a system of physical exercise. Walking five or ten miles is getting nearer to it. Whatever the form of exercise there must be interest in it. Forget the elements of your profession. Study the stars. Observe the rocks. Carry a camera with you. Train your lens on flowers, trees, birds, landscapes. Let it help your eye and mind to a new viewpoint and your body to new vigor and well-being.

If that which we choose for our diversion is well selected, if we follow it consistently, we shall be certain to find that our interest in it widens and deepens. Before long we shall have that excellent adjunct to the day's work of the scientific man—a hobby. Any man is the better for the possession of a judicious hobby. We, who are living in the circumscribed scientific world, are no exception to the rule. Through it we shall daily freshen the flavor of our routine work; we shall the better understand the bearing of our profession on the affairs of the world at large and the right relation of ourselves to the workers in the wider world.

This, like many other phases of the day's work, is a question of deliberately organized habit. We used to think of habits as largely a matter for lifted eyebrows, the facetious subject for New Year's resolutions. They may be that. But they may, also, be one of the most useful and satisfactory attributes of living. They are not necessarily dogged, senseless, fortuitous affairs. We may build them largely to suit ourselves. It is one of the pleasant things about psychology that it has taught us how to transmute our routine of physical life into a program of mental and spiritual growth. Even the posture that we school our body to assume presently finds its reflection in our mental attitude. The erectness of body, the level carriage of head, the vigor of muscular tone, the sturdiness of strength, the poise of coordinated muscles, all of these we may deliberately seek, and in the finding we shall renew our inmost character.

By this means we may choose what we shall be. True we shall never attain to all that we choose. It would not be well for us that we should, for life is quest as well as attainment and its fullest measure is realized in a reasonable mixture of the two ingredients. We shall not even have before us an unvarying, specific ideal, for that toward which we strive does not assume such definite form. Its outlines are always indistinct and always changing. But its substance we may picture in our mind and heart and as we contemplate that picture, so we shall grow toward it.

Through it all there is ever this truth: that to the scientist is granted the great privilege of a life of service to his fellow men. In the con-

sciousness of this privilege, realized little by little in the course of the day's work, there can come abiding joy.

VICE-PRESIDENT RUGGLES: Is it your pleasure to discuss the address at this time?

MR. C. L. MARLATT: I have been very much pleased in listening to this discourse. I think we all have been interested in the philosophical discussion of a broad subject. I think the greatest compliment to Professor O'Kane is to accept this address as a thoughtful, well-rounded subject, of interest to all of us and helpful to all of us. In lieu of discussion, if I have sensed the situation, I should be glad to move a vote of thanks and appreciation to the President for the Address.

MR. P. J. PARROTT: I rise to second the motion. I feel like repeating what Mr. Marlatt has just said. We have listened to this address with a great deal of pleasure. It is one which I think will prove profitable because of its common sense and its idealism. It has left us little to elaborate upon.

The motion was unanimously carried.

VICE-PRESIDENT RUGGLES: The next paper on the program is "The European Corn Borer Problem," by Dr. E. P. Felt.

THE EUROPEAN CORN BORER PROBLEM

By E. P. FELT, *State Entomologist, Albany, N. Y.*

Although the moths were reared in 1916, the insect was not recognized as a pest and carefully studied until the following summer. The investigations were continued in 1918, and the results are given in detail in the Massachusetts Bulletin (1).

SPREAD

A moderate extension of the infested territory was noted in 1918 and was followed in 1919 by the discovery of two widely separated infestations in New York state and an apparently very great increase in the infested area of Massachusetts, the latter extending from Cape Cod into southeastern New Hampshire. The known spread of the insect is summarized in the following statement:

AREA INFESTED

December, 1917	
Massachusetts	100 square miles
December, 1918	
Massachusetts	320 square miles

December, 1919

Massachusetts	1900 square miles
New Hampshire	20 square miles
New York	
Schenectady area	500 square miles
Western area	400 square miles

Too much emphasis should not be placed upon the apparently very great extension the past season owing to the fact that the insect was certainly present in New York areas in 1918, and very probably at least a year or two earlier. There are some who believe the borer may have been in most of these areas for nine years or thereabouts. We would prefer additional data before accepting such an estimate without reservations.

It was believed at first that the European corn borer was brought into this country with hemp imported for the use of rope walks near Boston, though there is a possibility that it may have been introduced with broom corn and in this connection it is interesting to note that there is a broom factory at Everett, Mass., an extensive broom industry at Amsterdam, N. Y., and at least one small broom factory at Irving, Chautauqua County, N. Y. It should be noted that the New York infestations have excellent rail connections with the older infested territory north of Boston. Since the European corn borer may be carried in the larval stage in the stems of a considerable variety of plants, these outlying infestations and in fact the presumably original one near Boston may have originated through the shipment of any one of a number of infested plants. It has even been suggested that green house plants may have been the original carrier, though hemp and broom corn are presumably the more probable mediums of transportation. It is a little remarkable that all infested places at the somewhat distant points are directly west and none southwest of Boston. The infestations directly south of Boston were probably brought about by the shipment of green corn to summer hotels.

Conferences and Hearings

1918

September 6, conference at Boston, Mass., attended by a number of entomologists and agriculturists from the northeastern United States, together with representatives of the Federal Bureau of Entomology.

1919

February 7, conference at Albany, N. Y., attended by representatives of the New York state commission of agriculture, official

entomologists of New York and representatives of the Federal Bureau of Entomology.

February 12, hearing at Washington before the Senate Committee on Agriculture, attended by entomologists and agriculturists from Massachusetts and New York and representatives of the Federal Bureau of Entomology.

February 13, hearing at Ithaca, N. Y., held by the Council of the Department of Farms and Markets and attended by representative agriculturists and entomologists of New York state.

August 28, 29, conference and field survey at Albany and Boston, respectively, attended by a number of commissioners of agriculture and entomologists mostly from the middle and eastern states.

October 3, 4, field survey by representatives of the Federal Horticultural Board, agriculturists of Indiana and the state entomologist of New York at Boston and Schenectady respectively.

October 8, hearing at Washington before a subcommittee of the Senate Finance Committee, attended by commissioners of agriculture and entomologists mostly from the middle and eastern states.

In addition the Federal Horticultural Board has held three hearings, and one conference in the past two years and the problem has been discussed at various meetings, among which may be mentioned our last annual meeting at Baltimore and the recent meeting of the National Association of Commissioners and Departments of Agriculture, held at Chicago, November 12.

Publicity and Important Publications, 1919

1. Caffrey, D. J., The European Corn Borer Problem. Econ. Ent. Journ. 12: 92–98.
2. The European Corn Borer, U. S. Dept. Ag., Bu. of Ent., in Coöp. with Ext. Serv. St. Agr. Coll. (poster).
3. Felt, E. P. Cornell Extension Bul. 31, pp. 35–42.
4. The European Corn Borer. Dept. Farms and Markets, Div. Agr. Circ. 182.
5. Vinal, S. C., and Caffrey, D. J., The European Corn Borer and Its Control. Mass. Agr. Expt. Sta. Bul. 189, pp. 1–71.
6. Caffrey, D. J., The European Corn Borer, A Menace to the Country's Corn Crop. U. S. Dept. Agr. Farmers Bul. 1046, pp. 1–28.
7. Felt, E. P., European Corn Borer. Univ. St. of N. Y., School Bul. Je. 1 (poster).
8. Proceedings of the Conference on the European Corn Borer held by the National Association of Commissioners of Agriculture, with state entomologists and representatives of the United States Department of Agriculture. Dept. Farms and Markets (N. Y.), Div. Ag. Bul. 123, pp. 1–74.
9. Woodbury, C. G., European Corn Borer Investigations. Congress. Record, Nov. 4, pp. 8409–8411.
10. Marlatt, C. L., European Corn Borer. Rept. Fed. Hort. Bd., Oct. 1, 1919, pp. 8–13.

The federal poster (2) was widely and generally distributed in areas where there appeared to be a reasonable possibility of the borer being present. This was particularly true of New York state after the discovery of the Scotia infestation. The New York poster (7) was generally distributed to the schools of the state and in addition, popular articles were prepared, sent to practically every local newspaper and published by a very considerable proportion of them. Cornell Extension Bulletin 31 (3) was generally distributed throughout the state of New York, an edition of 40,000 being printed. The United States Farmers' Bulletin (6) was generally distributed throughout the country, specially in the northeastern United States. It is worthy of note in this connection that while the initial discovery of the two infestations in New York state were brought to light through publicity, the extension and subsequent delimitation of these areas was due in considerable measure to systematic scouting.

There are serious limitations upon publicity so far as such an insect as the European corn borer is concerned and yet it is believed efforts along this line have amply justified themselves. The experience of the past year is a very strong argument in favor of systematic, well directed scouting as an adjunct to publicity. Neither should be used to the exclusion of the other.

In addition to the official publications listed above, a few specially interested states and Canada have published short bulletins or leaflets on this pest and there have been numerous popular accounts appearing in the agricultural press in particular. It is noteworthy in this connection that Mr. Allen's article in the *Country Gentleman* of January, 1919, was responsible for bringing the Scotia, N. Y., infestation to the attention of the Cornell entomologists.

Scouting

The scouting of the last few months has been done mostly by agents of the federal government and the limitations in connection with the work emphasize the difficulty (10, p. 9) of quickly ascertaining the precise extent of the infested area. The approximate size of the New York areas appears to have been determined and it would seem that if the insect had become established in any numbers in other sections of the country it would have been brought to notice before this.

Quarantine

The Federal Horticultural Board promulgated Quarantine No. 36, effective October 1, 1918, and the states of Massachusetts and New York have also laid quarantines, modifying them as developments warranted. These quarantines were all limited to corn on the ear and

cornstalks. The state of Florida has laid a most sweeping embargo upon the shipment of plants or parts of plants from the infested area, while the Canadian government, by order of council, has prohibited the shipment into the Dominion of corn fodder or cornstalks from the infested area.

The extension of Quarantine 36 to include the entire infested area has been seriously considered by the Federal Horticultural Board and owing to the uncertainties of the situation it has not, due in part at least to the difficulties in ascertaining the limits of the infested areas, been put in force.

Economic Status

There have been, during the last few months some statements voiced (9, 10) tending to indicate that the European corn borer may not prove to be an insect of much economic importance. These opinions appear to be based upon the fact that there was considerably less injury in the infested area in Massachusetts in 1919 than was true of some of the badly infested fields in 1918. Apparently little allowance has been made for the possible beneficial results following a general, though perhaps not entirely effective clean-up, for the activity of ephemeral and unreliable parasites, for the fact that seasonal differences may have been very unfavorable to the borer, and the obvious variations in the infested area.

A general clean-up, even if a somewhat indifferent one, would result in the destruction of millions of borers and of itself should considerably lessen injury from the second brood. A well known, minute egg parasite, notably extremely variable in abundance from season to season, severely checked the borer. The development of the second brood injury in eastern Massachusetts was nearly a month later[1] in 1919.

[1] It may be significant that both the Blue Hill (mean 68.4°, departure from normal +1°) and the Concord (mean 68.3°, departure from normal 0°) Massachusetts records show a normal or a little higher than normal monthly mean temperatures for these stations in August, 1918, and decidedly subnormal records (mean 64.5°, departure from normal −2.9° and mean 65°, departure from normal −3.3° respectively) for the same month in 1919, a period of practically continuous development and growth for the second brood. Taking 43° F. as the critical temperature (it is probably higher for this season of the year) Blue Hills would have effective temperatures for August, 1918, amounting to 787.4, an increase of approximately 4 per cent above the normal and for August, 1919, effective temperatures of 666.5, a decrease below the normal of nearly 12 per cent, the total range between the two seasons for that month amounting to nearly 16 per cent of the normal effective temperatures. The Concord records show a normal (mean 68.3°, effective temperatures 784.3) for August, 1918, and a marked decrease (mean 65°, departure from normal −3.3°, effective temperatures 682) in 1919, amounting to more than 13 per cent of the effective temperatures. These figures justify expecting a retarded development, which latter was substantiated by field observations.

Thus, a combination, rarely to be expected, greatly mitigated the damage of 1919. It is hoped that such conditions will prove more frequent in the future. It is one thing to note a deficiency of this character and quite a different matter to allow such variations to materially influence a policy which may have far-reaching effects. It is impractical to apply the general code of the criminal law and hold an insect incapable of harm until it has proved its ability to cause serious damage over wide areas year after year, because such demonstration would very probably make it impossible to economically check or control the pest.

Considerable stress (8 p. 66, 9 p. 8410) has been laid upon the practical immunity in certain small plots at Medford, Mass., of a rank growing southern corn and this has been used to support the hope that dent corns of the south would escape serious injury. The damage in none of these plots was serious and in view of the decided tendency of the moths to select early varieties for the deposition of eggs, a habit most evident in New York state, we hold it to be unsafe to rely to any material extent upon such a slight and comparatively unreliable indication.

The occurrence of but one brood with consequent limitation of injury in the infested areas in New York state is conclusive evidence of the effect a relatively slight change in climate may have upon this insect. Of itself, it justifies a pessimistic attitude toward the reduction in injury in eastern Massachusetts in 1919, and at the same time affords no substantial basis for any such relative immunity for the larger portion of the corn belt. There is every reason for expecting two and in the more southern portion of the country three broods or generations each season. The prolonged period of activity might be expected to offset in large measure, at least, any advantage accruing to a rank, rapid growing variety of corn.

The possibilities of clean culture or modifications in agricultural methods, likewise appear to be overstressed (9 p. 8410) when it is remembered that these conclusions are based upon examinations of comparatively few fields and that even in the older infested areas in Massachusetts there is considerable local variation in the degree of infestation, a condition much more marked in New York state. This is no argument against the utilization of such methods to the utmost. It is simply a warning against depending upon them to any great extent until their utility has been demonstrated.

There should be due conservatism in the estimation of probable injury and the same is equally true, if not more important in regard to approximating probable immunity.

Whether we wish to do so or not, we must shortly make a decision as to the economic status of the European corn borer. If we admit that it has serious potentialities and is capable of causing even a 10 per cent loss to the crop, we still have an insect of the first magnitude, worthy of most careful investigation and justifying the utilization of every reasonable measure to prevent spread and promote the control of the pest. Should it be decided, however, that this insect is of slight importance and is destined to have little effect upon the corn crop of the country, then we are compelled to hold that a moderate amount of knowledge concerning the insect is all that is necessary, that there is little justification for exhaustive investigations and that large scale control operations are indefensible.

If the first be true, states vitally concerned and the federal government should make liberal appropriations for the further investigation and control of this insect. Otherwise, as professional entomologists, guardians of the public welfare, we should oppose all efforts to secure money for any such purpose.

Problems Affecting Control Work

The Bureau of Entomology last August proposed first of all to determine the present distribution of the insect as a basis for a quarantine and other control measures. There are practical difficulties (10, p. 9) in following this plan and if there is to be effective control it will be necessary, in our opinion, to push more than one line of activity or else serious efforts to control the pest should be abandoned. The experience of the past season discloses some habits which emphasize the difficulties of handling the situation. The insect breeds in a considerable number of plants, over fifty, and has been found in the stems of quite a number of others. It is very probable that the borer multiplies freely upon relatively few plants and that practically speaking we can ignore its presence in many. We may have with this pest a duplication in some respects of our experience with gypsy moth food plants. There is need of more information concerning methods of spread, though work in Massachusetts the past season shows that individual females may make a single flight of as much as 287 yards and that marked individuals were recovered at a distance of 600 yards. Females may live 33 days, the eggs being deposited in small masses during a considerable portion of this period. The maximum egg production from one individual was 1,192. The occurrence of the borers in underground stems and their occasional presence in farm crops such as oats, greatly complicates the problem of control.

The apparent possibilities justify serious questions as to the feasibility of control. This latter can be determined only by field

operations on a comprehensive scale and in view of the destructive potentialities of the borer such an undertaking is favored.

Secondary Conditions Affecting the Problem

The control of the European corn borer is by no means a simple problem in entomology or a question of organization. The infestation of three and possibly four states vitally concerns as many different sets of officials as well as representatives of the federal government and all in turn are dependent upon law making bodies for the necessary appropriations. It is entirely possible for one group or even a portion of a group to largely prevent effective work and by the very nature of the case there is such an excellent opportunity to evade responsibility, that at times it is almost impossible to ascertain the real cause of unsuccessful coöperation or activity.

These statements simply describe the situation as it exists and justify a question as to the desirability and possibility of evolving more effective ways of handling limited infestations of destructive insects. It is a condition not peculiar to entomology or even to science. It is something found in many lines of governmental activity.

Destructive insects have been introduced into this country in earlier years and similar developments may be expected in the future. It is only necessary to refer to the gypsy moth, the San José scale and the cotton boll weevil, to bring to mind three exceedingly destructive pests which were detected shortly after they obtained a foothold in the country and were allowed for one reason or another to extend their range over considerable areas. All three have been exhaustively studied and many printed pages have been devoted to discussing their habits and the most effective methods of control. With these three in mind, one might conclude that American economic entomologists have been more efficient as investigators than executives. Very nearly the same conditions obtain in relation to chestnut blight and the white pine blister rust.

A survey of the situation in the light of our present knowledge justifies the belief that it would have been comparatively inexpensive and certainly highly profitable to have attempted the extermination of these three pests as soon as they were found, even though it involved considerably larger expenditures than would be necessary after more information was available. It may be argued that eradication was impossible in the earlier days because of the lack of information. This is most easily answered by the statement that much of the most valuable data in regard to such problems come from field experience. We would not underrate in the slightest the desirability of exact informa-

tion but if we wait until everything is known very little or nothing will be accomplished.

Quarantine and Extermination

The introduction of the San José scale in the east was a prime factor in bringing about the establishment first of state and later of federal quarantines, both designed to limit and prevent the distribution of injurious insects and plant diseases. Quarantines, like other human agencies, have their limitations and if they are to attain the fullest measure of usefulness, should be supplemented by exterminative measures.

There are several fundamental weaknesses in our efforts to exterminate insects. In the first place, it appears very difficult to secure a general unanimity of opinion as to the economic status of a pest before it has spread to a material extent and caused serious losses. Such delays give the insect an opportunity to multiply and if it be reasonably active and prolific, it may within a season or two escape beyond all reasonable possibilities of control. Then there is the necessity of securing funds from the state or national government and in the case of Congress at least it is very difficult to secure special appropriations with a reasonable degree of promptitude.

These conditions are evident to all. Should we not, therefore, seek to provide in some manner or other for a reserve fund which could be utilized for just such emergencies? It would make possible the beginning of operations at the outset and at the very time work could be prosecuted to the best advantage. It of course follows that investigation and scouting should also be pushed so far as necessitated by conditions but, if we are correct in our judgment, these three activities should be in a measure coördinate and interrelated rather than one being dependent upon the others. Our present quarantine laws are the outcome of years of work and desirable modifications along the lines outlined above can hardly be expected without systematic effort for presumably several years.

Control Work and Appropriations

Practically speaking there has been no general control work in the field aside from that done by the states of Massachusetts and New York. The state of Massachusetts attempted to compel property owners to clean up infested land at their own expense, the state even doing the work and assessing the costs against the property. Subsequently the Federal Bureau of Entomology undertook a limited amount of this work in Massachusetts on a coöperative basis and late in the spring of 1918, nearly $100,000 was expended by the state of Massa-

chusetts under the direction of Mr. L. H. Worthley, detailed from the U. S. Bureau of Entomology for this work, in a systematic effort to clean up the entire infested area. Unfortunately, the money became available so late in the season that it was not possible to do very satisfactory work.

The state of New York expended nearly $100,000 in a rather thorough clean-up of all of the then known infested area and generally speaking exceedingly satisfactory results were obtained. The work was done in the belief that there were two generations of the borer in the New York area and that there would be substantial assistance from the federal government. This latter, so far as clean-up work is concerned, has not materialized. Developments late in the season clearly demonstrated that there was but one generation in the New York areas and a correspondingly slight injury. In other words, control and extermination in the cooler portions of the corn growing area of New York state, the parts now infested by this insect, is of much greater importance to the country as a whole, particularly the middle and southern corn growing states and is, therefore, a national rather than a state problem.

The work against the European corn borer both in 1917 and 1918, by the state of Massachusetts and the Federal Bureau of Entomology, was practically limited to investigations which latter have been published in bulletins cited above.

The American Plant Pest Committee should be credited with being the first organization to so fully appreciate the serious nature of the European corn borer as to adopt measures which resulted in the introduction in the United States Senate of a bill (S. 5290) appropriating $500,000 for work against this pest. Unfortunately, representatives of the Bureau of Entomology did not at that time see the need of any such large appropriation and desirable coöperation was lacking. It was intimated that representatives of the bureau were then willing that a moderate sum, $25,000, be appropriated for practical work pending the acquisition of more information during the season of 1919. This was before the insect had been discovered in New York state. Shortly after the Scotia, N. Y., infestation was reported, the secretary of agriculture was prepared to recommend $100,000 for control work and very soon thereafter the sum was increased to $500,000. An item for this amount was eventually included in the agricultural bill, which later failed to pass because of the filibuster at the end of the session of the last Congress. The Agricultural Appropriation Bill passed by the special session of Congress contained an item of but $250,000 instead of the figure accepted by the previous Congress. This bill passed and the amount named became available early in

August, altogether too late for effective work in the spring. A very considerable increase in the area of the infested region led the secretary of agriculture to ask for an emergency appropriation of $500,000 in addition to the $250,000 just mentioned and Doctor Howard submitted to the Albany-Boston conference, held the last of August, an itemized schedule showing how it was proposed to use these funds.

A special committee was appointed at the corn borer conference just mentioned and brought in resolutions, subsequently adopted without a dissenting voice, in favor of asking Congress for an appropriation of $2,000,000 to be made available for use as rapidly as an effective organization to carry on the work could be secured and developed. This was in addition to funds already appropriated. At the hearing before a subcommittee of the Senate Committee on Finance, the request for $2,000,000 was strongly urged by a goodly number of commissioners of agriculture and official entomologists from the middle and eastern states, although a representative of the Federal Horticultural Board went on record to the effect that $500,000 was all that could be used advantageously at the present time. In view of these conditions, we could hardly expect more than the smaller sum and as a very pessimistic note was shortly thereafter voiced by an Indiana official (9), it is perhaps not surprising that Congress decided to put the entire matter over until the regular session.

The secretary of agriculture has recommended to the present session of Congress an appropriation of $500,000 to be immediately available for European corn borer work. Basing estimates upon the work in New York state last spring, it would require approximately $200,000 to clean up the eastern infested area in that state and about the same amount for the western territory, a total of $400,000. Common prudence would dictate some allowance for emergencies and the possible discovery of additional infested territory. If these outlying areas are a serious menace to the corn belt, and this seems to be the consensus of opinion among economic entomologists, we can hardly recommend the expenditure of less than $500,000 in the New York state and adjacent territory.

The situation in eastern Massachusetts and southeastern New Hampshire demands that some measures should be taken to prevent an undue multiplication of the insect. There is a possibility that the funds for the demonstration project, covering about six towns in the badly infested Massachusetts area may prove to be insufficient. There is also scouting, an essential phase of the work, testing on a large scale possibilities of control by modified cropping, quarantines, etc. It would seem as though at least $500,000 should be available for work of one character or another next spring in the New England states.

If the insect is really a serious pest, and it is considered decidedly unsafe to assume otherwise, an emergency appropriation of $1,000,000, immediately available, would seem the minimum amount which could be recommended and with our present knowledge plans should be made for the expenditure of approximately the same sum in the fiscal year of 1920–21. It is believed that such a program is justified on both practical and scientific considerations. It may mean the expenditure of some money which could be used to a better advantage when we come to know the problem more intimately though this would be more than offset, in our estimation, by effective action before there has been a greatly increased spread of the pest. This program is positive, conservative, so far at least as preventing injury is concerned, and appears to be the most logical which can be adopted at the present time.

A Tentative Plan

The situation is such that it seems advisable for the writer, without in any way attempting to dictate or to suggest that his opinion is better than that of others, to outline a plan which might be utilized as a basis for coöperation between federal and state officials. It is the result of repeated examinations of conditions in eastern Massachusetts and the writer's familiarity with the situation in New York state and may well be considered as an elaboration of a plan outlined by Doctor Howard at the European corn borer conference last August.

The maintenance of such quarantines and restrictions upon the growing and distribution of corn on the ear, cornstalks and other plants or parts of plants as may be justified by conditions is of prime importance.

Special care should be exercised to avoid burdensome and unnecessary restrictions and at the same time secure at least a moderate degree of protection. We are inclined to believe that the efficacy of quarantine measures can be greatly increased by restricting cropping somewhat as outlined below and that this latter would be much less burdensome than the attempt to enforce what might be regarded as thoroughly satisfactory quarantine regulations.

Outline for Sparsely Infested Areas

1. The continuance of the publicity campaign throughout the United States in an effort to secure general coöperation in locating infestations.

It is significant, despite the limitations of this method, that the first information of the pest occurring in Schenectady and Erie counties, New York, came to hand as a result of publicity work.

2. The development and maintenance of adequate scouting forces for the purpose of quickly determining the limits of the various infested sections and also for making special examinations in any particularly suspicious areas.

Scouting is a most valuable supplement to publicity and the two should be worked together if the best results are to be secured. The Federal Bureau of Entomology already has a number of scouts at work in various parts of the country. There are difficulties in securing enough.

3. The speedy organization of a clean-up campaign for the more western areas.

This is designed primarily to destroy the wintering borers in cornstalks and weed stems in cornfields in particular. It is a direct and a fairly effective method of keeping the infestation down to the minimum, and appears to be of prime importance in checking the westward spread of the borer.

4. A measurable regulation of corn planting in the infested areas next year as follows:

(a) Plant throughout the infested territory small plots of early corn designed to attract the moths.

(b) Destroy such early plantings before the borers attain maturity in localities where conditions justify such action.

It is comparatively easy in late July or early August to locate the work of the borer in sparsely infested areas. Scouting territory where there is but one brood at this time and the prompt destruction of the occasional infested hills appears to the writer as a promising method of not only locating the limits of infestation but of restricting spread. A splendid opportunity to test its efficiency was missed last season because of the expected development of a second brood in New York state.

(c) Plant the greater part of the corn crop two or three weeks later than the very early corn and in this manner avoid infestation to a large degree.

The immunity of somewhat late planted corn in the Schenectady area was most striking, even in adjacent fields and with the same variety.

(d) Prohibit in all infested areas the growing, within fifty feet of early corn, of celery and other garden crops liable to be infested and commonly transported by commercial agencies.

There have been to the writer's knowledge no extensive tests of possibilities along this line and before we conclude that the insect cannot be controlled and prevented from establishing itself in the corn belt, we believe that some such methods should be tried over an ex-

tended area. We are only at the beginning in learning the possibilities of insect control through crop manipulation.

5. A careful and exhaustive investigation should be made as soon as possible to determine the probable origin of the scattering infestations along the southern shore of Lake Erie.

It goes without saying that a knowledge of methods of spread is a most valuable aid in preventing further dissemination.

Outline for the Earlier Infested Territory

The situation in eastern Massachusetts, especially in the badly infested area, is such as to require somewhat different treatment. It is very probable that the early planting of small plots of corn and the restrictions in regard to growing garden crops likely to be infested near corn would prove of considerable service. There is need of large scale demonstrations to ascertain the most practical methods of handling the pest in eastern Massachusetts and in time they may have to be extended to other portions of the country. There is a possibility that systematic and general work along the lines indicated below would ultimately result in a considerable decrease and perhaps a somewhat general limitation of injury.

Corn and other infested plants in eastern Massachusetts should be handled in such a way as to reduce to a minimum the possibility of borers surviving, the most promising methods being the following:

(a) Plow thoroughly, preferably in the fall and endeavor to cover the stubble deeply, since such measures undoubtedly destroy many borers.

(b) Put the corn fodder in a silo or if that is not possible cut and shred the cornstalks, even salting them so as to promote their consumption by cattle.

(c) Where other treatment is impossible, the stalks should be composted or burned provided the expense is not out of proportion to the benefits secured.

(d) Partly consumed cornstalks should not be mixed with manure unless the latter is composted or handled so it will heat.

(e) Cornfields and adjacent areas should be kept free from weeds and nearby weedy areas at least should be burned over during the fall or early spring.

The situation in eastern Massachusetts is so serious that we believe it to be of national importance to test possibilities on a large scale and for this purpose we would favor the expenditure by the federal government of a liberal sum the coming season, possibly $500,000 in work of this character.

Briefly, the urgent need is for a large appropriation, the larger the

better, to be used in testing on a comprehensive scale any measures likely to give a considerable degree of relief and greatly delay if not prevent the invasion of the corn belt by the European corn borer. The conditions are such that we question seriously the wisdom of making demonstrations on such a limited scale as will permit the pest to greatly extend its range during the season or seasons this practical work is in progress. We must endeavor to hold the insect and at the same time ascertain the possibilities in relation to control.

VICE-PRESIDENT RUGGLES: This paper is now open for discussion.

MR. C. L. MARLATT: I hope this body will not be alarmed at the volume of the documents I am carrying. This bundle includes a few papers to which I may wish to refer.

I agree with Dr. Felt heartily as to most of his discourse. I hardly think he will want me to agree with his criticism of a certain member of the Horticultural Board. I am glad to say that this criticism is founded largely on misinformation. The facts are all a matter of record. The $500,000 supplemental estimate, to which he referred and which is still before Congress, was transmitted to Congress by the Secretary of Agriculture on July 29, 1919, in connection with an urgent deficiency bill then under consideration and, therefore, long before the hearing granted by the Senate Committee to representatives of various states on October 8 following. The first hearing on this estimate was August 23, 1919, at which hearing Messrs. Quaintance and Walton of the bureau presented the argument as to the needs for the money. Both Dr. Howard and the speaker were at that time absent from Washington. At the hearing on October 8, 1919, both Dr. Howard and the speaker were present. The speaker's remarks were chiefly in calling the attention of the committee to the Secretary's letter in which is voiced and explained the need for the additional $500,000 to meet the corn borer situation during the season of 1919–20. The speaker is perfectly willing to accept the responsibility for whatever influence he may have exercised in developing the determination of the amount which was so recommended.

DR. FELT: May I ask just one question? I thought, and I am speaking in all honesty, that you said that $500,000 was all that could be used.

MR. MARLATT: I pointed out that that was the amount submitted by the Secretary of Agriculture and that that sum, with the existing $250,000, making a total available fund of $750,000, was believed by the department to be sufficient to cover the survey and cleanup work which could be wisely and profitably carried out in the season 1919–20.

The amount of funds that can be so utilized is a question which

interests us all. To determine the funds needed and the work which should now be undertaken, we must consider the known facts concerning the corn borer. We do not want argument or mere statement of opinions. As a body of technically trained men who are the advisers of the farmers of the country, and of the legislators of the different states, and of Congress, we can recommend only what we believe to be justified. We have reputations as entomologists and practical men which we want to maintain, and we should realize that our recommendations will be passed upon by men quite as competent as ourselves, to judge their urgency and reasonableness. They must be supported, not only by actual conditions establishing the urgency, but also by a real possibility of accomplishment of the work planned. Neither Dr. Howard, representing the Bureau of Entomology, nor the speaker, representing the Federal Horticultural Board, could afford to go to Congress and make exaggerated statements both as to damage and possibilities of extermination to dislodge huge appropriations of money. The members of these Congressional committees know a great deal about these problems and have often very definite ideas as to the needs. If you went before these men as often as I do, you would be surprised to find how much they know about these things and how fairly they appreciate the hue and cry that has been made about various pests that have come up in recent years and which have been represented as threatening the fabric of the country and they have noted that this fabric has not been rent asunder! We have lived through the period when the fruit crop of the country was going to be wiped out by the San José scale and have even lived to see this same scale rated by many as the greatest blessing that has ever come to the fruit grower. We were led to believe that the potato industry would be wiped out by the powdery scab, and large appropriations were obtained from Congress and spent in attempting to stamp out this disease. Later we discovered that our control work was absolutely futile and that we were simply wasting money and making ourselves foolish and, with a huge appropriation unspent, the work was stopped. That disease has scarcely been heard of since. It disappeared with the termination of its exploitation!

It does not follow that this will be the case with the corn borer. We are fairly agreed that the corn borer is a new pest to this country and that it attacks corn and other crops. Any new pest that attacks important crops is of importance. In everything that I have said about this insect I have indicated that I realized its importance and that its power for harm had been demonstrated in Massachusetts. When this insect was new to us and we saw the damage it was doing, the statements which now may seem exaggerated were perhaps justi-

fiable, but we have now had two years of careful study of the insect. What are the conditions today? They have been enumerated in part by Dr. Felt. Several of these are very hopeful and should very materially affect our attitude and recommendations with respect to the corn borer. We should look at these important modifying considerations fairly and not try to conceal any of them or push them aside on the fear that they may affect our appropriations and affect the public's appreciation of the subject.

My experience with Congress for over thirty years has been that by frank statements one gets a great deal farther than by exaggerated statements. In this way, for example, moneys have been secured for the pink bollworm work. Appropriations of $500,000 and $600,000 have been obtained on the statement that the money was wanted as an insurance fund which might or might not be used. We have not represented to Congress that the cotton crop will be doomed unless the sums were given, but a plain statement of conditions has never failed to get what was needed.

Now what is the situation with respect to the European corn borer? It was discovered only a few years ago, but we now have every reason to believe it has been in this country for ten years. I think the evidence of this is sufficiently clear to leave very little reasonable doubt. In the years 1909 and 1910 there was a great shortage of broom corn in the United States and nearly 10,000 tons of this commodity were imported chiefly from Austria-Hungary. Of that enormous mass of broom corn some 500 or 600 tons, a comparatively small portion of the importations, went to a factory in Boston, and a similar amount to the eastern New York invaded district. Approximately eight tenths of the total importations went elsewhere, most of it into the Mississippi Valley, to New Orleans, St. Louis, Chicago, and points in Kentucky, and was distributed from these centers to many, perhaps hundreds, of broom factories. We have made very little investigation of that distribution of broom corn, in fact, we have just begun it. We have traced a few of the shipments to destination and have made a very brief investigation of the field conditions surrounding those factories. This tracing and field inspection work is now temporarily discontinued, due, I am advised, to the unfavorable conditions entailed by midwinter. We expect to continue this work next season making a thorough investigation of the whole Mississippi Valley region to determine how widely the insect may have been carried by such broom corn.

Of first importance is the determination of the distribution of this insect in the United States. In 1918 the inspection force was very limited. This year, shortly after the Congressional appropriations

became available in July, Mr. Worthley, who had been put in charge of the cleanup work, was also assigned the charge of the inspection force, and the force of trained men for this purpose was enormously increased. Instead of the half dozen inspectors of the year before we put upwards of a hundred men into this service. Nearly 100 inspectors were assigned to Massachusetts, a group of 20 or 30 to New York, and later in the season others to Pennsylvania, Ohio, Indiana, Illinois, and elsewhere in the Mississippi Valley. As a result of that greatly enlarged inspection service our knowledge of the distribution of the corn borer has been very greatly increased. Its present known distribution has been pointed out by Dr. Felt and that the insect has not been found west of New York or Pennsylvania. This was not a sudden spread of the insect from last year, though it has been very frequently so described, but was rather merely the determination of additional territory, some, and perhaps much, of which had been infested probably for ten years. That we have now determined the limits of the distribution of this insect is not at all likely, as is evidenced by the known distribution of the imported broom corn just described and the very fragmentary nature of the surveys, even where they have been most thoroughly conducted.

I should like to discuss now for a moment the evidence indicating the economic importance of the insect as indicated by its abundance and the amount of damage it has occasioned to corn. Its damage to other crops is chiefly significant as indicating that such crops may be a means of disseminating the borer.

Over much of the infested area in coastal Massachusetts and New Hampshire, the insect is very rare. I have here records submitted by Messrs. Worthley and Caffrey indicating the results of the scouting work in Massachusetts and other states. These records apply to the new areas of infestation determined in 1919, practically all of them subsequent to July 1. In most of these towns or townships the actual findings of larvæ were limited to from one to a very few and in most cases these after several days of intensive search. The number of larvæ recorded is not always, however, indicative of the extent or amount of infestation because as a rule, after finding an infested field, the inspectors went on to other townships. The amount and extent of infestation is, however, indicated by the number of man days spent in a township, and the number of fields inspected before the borer was found, and also, to some extent, by the number of larvæ found in such fields. On the other hand, the reporting of a large number of larvæ in a township is also not indicative of very much. For example, in one township the record is given of over 40 larvæ being found, but the statement is made that this town contains over 40

square miles and that actually the percentage of infestation of this township was very light. Looking at it one way, this record shows only one larva to the square mile after a painstaking search!

The inspection work with respect to the corn borer has been necessarily limited. Time and funds have not been available for intensive work such as has been done, for example, in the pink bollworm surveys in Texas. As an illustration, Dr. Hunter reports that 209 man days were spent on a single cotton field, that is, 1 man 209 days or 209 men 1 day. On the 209th day a single worm was found. After that 100 other man days were spent in the same field without finding another worm,—that is, intensive search. We have not been able to make that sort of intensive search in the case of the corn borer, but undoubtedly in a great majority of the towns in Massachusetts and elsewhere where the insect has been found it would probably be a very difficult matter to recover the insect again. The records indicate, however, that the insect is still rare over much of the district that it now invades and over which, in large part at least, it has been in existence for a considerable number of years.

In this connection Mr. Worthley states in his letter transmitting these tables that "it is rather difficult to give much of an estimate of percentage of stalks and ears infested in these different fields. I am sure, however, it does not exceed 1 per cent as an average." The tables referred to are submitted herewith.

The full records of the survey work in the latter half of 1919 in the states now known to be infested and in other states is also a matter of interest—the survey in the infested states extending very much beyond the area actually found infested. Records are not available for Connecticut, Indiana, Kentucky, Illinois, and other western states, where some work was also done late in the season.

In New York state the same conditions as to the spread and abundance hold true, only the insect is much more rare on account of its single broodedness in that state.

The corn borer situation in New York and in Massachusetts has been investigated independently by three or four different bodies of experts outside of the working forces of the Bureau of Entomology. It was investigated by the Federal Horticultural Board three times, twice in August and again about the first of October. The representatives of the board went over the ground very thoroughly, not merely going through the special exhibit fields, but stopping at many others. A good deal of difference was noted in those selected for the board to inspect and those within the district taken at random. Again, a body of corn technologists, specialists of the Bureau of Plant Industry of the department, went over these areas in New York and Massachu-

setts in September to see if it was desirable and necessary to develop a resistant corn which would be immune to the corn borer. They came

INFESTATION INDICATED BY SCOUTING OF 1919

Township	Man days	Number of fields examined	Number of fields infested	Number of larvæ taken
New Hampshire:				
Kingston	35½	328	1	7
Plaistow	5	50	1	7
Seabrook	4	29	1	4
Massachusetts:				
Abington	3	86	1	1
Avon	8	238	1	2
Bedford	1½	2	2	6
Bourne	9	55	1	5
Bradford	1	1	1	7
Brewster	4	12	1	few
Brockton	3	41	3	5
Concord	2½	1	1	1
Duxbury	8	98	1	1
Framingham	20	416	3	2
Georgetown	*	*	3*	few
Hamilton	1	1	1	2
Hanson	14	339	1	6
Kingston	25	269	2	16
Merrimac	1	58	1	1
Methuen	1	1	1	6
Middleboro	42	679	3	17
Natick	1	1	1	2
Orleans	20	184	1	1
Pembroke	12	119	1	few
Plymouth	30	619	6	43
Provincetown	3	11	1	8
Sudbury	9	238	1	few
Truro	4½	26	2	6
Tyngsboro	8	108	1	2
Wellfleet	6	25	1	7
Western New York:				
Brant	4½	7	3	36
Cheektowaga	2	26	1	2
Collins	6	23	1	1
Dayton	¾	6	1	1
Eden	3	16	1	few
Evans	1½	5	2	4
Hamburg	7½	34	1	1
Hanover	1½	4	1	1
North Collins	3	13	3	4
Persia	3½	17	1	3
Perrysburg	1½	4	1	1
Pomfret†				
Sheridan†				

* Scouted by State Board.
† No record.

back with views of the situation which corresponded closely with those of the board. Early in October a commission from Indiana headed

by Dr. C. G. Woodbury, director of the State Experiment Station, went over the same ground. This commission included also the state entomologist, Mr. Frank N. Wallace, Mr. L. M. Vogler, representing

RECORD OF FIELD INFESTATIONS BY STATES, 1919

Townships	Number of townships inspected	Man days	Number of fields examined	Number of fields infested
New Hampshire	37	979	8,727	3
Massachusetts	146	1,015	22,928	42
Eastern New York	60	983	4,758	37
Western New York	46	179	1,162	16
Pennsylvania	10	13	311	0
Ohio	16	29	381	0
Rhode Island	1	12	72	0

the farm associations of Indiana, and Mr. William H. Larrimer, an entomologist of the United States Bureau of Entomology in charge of a field station at Lafayette, Indiana. I have here the reports from Dr. Woodbury and Mr. Wallace. They are in substantial agreement with the viewpoint of the board and of the department. That is the way the corn borer situation impressed these independent bodies of men who were fully competent to determine what the insect is really doing.

I wish now to discuss certain hopeful features that put a rather different aspect on the corn borer situation.

The first of these is the factor of the number of broods. The fact that it is single-brooded in New York state has been pointed out by Dr. Felt. As a single-brooded insect its damage in that state has been negligible. In October, I asked Mr. Van Buren, who had charge of the corn borer work in New York, how much damage it had done in New York state. His answer was that it had done practically no damage.

In Massachusetts the insect is double-brooded and the damage has been severe in special fields, but taking the area as a whole, as already indicated, the percentage of damage is very low. I doubt, however, if any of the fields have shown more than 10 per cent damage. Understand what I mean by 10 per cent. I mean 10 per cent loss of corn. I do not mean 10 per cent of stalks infested.

It has been stated here that the damage in the season 1918 was even worse than in 1919. I have here the statement of Mr. S. C. Vinal on the damage of the 1918 crop. It will be remembered that Mr. Vinal is the man who discovered the corn borer and was in charge of the work for Massachusetts until his sudden death last winter from

influenza. Mr. Vinal was altogether an exceptional man and his death is a great loss to applied entomology. His statement made at the board hearing of August 27, 1918, in answer to a question as to the damage actually caused by this insect to field corn and sweet corn, is as follows:

> Field corn is not grown very extensively around that area. We have been trying to find field corn but it is pretty hard to find it. The only way we can get it is to plant it ourselves. From a farm of five acres of very early sweet corn that I have been working, when that corn was picked and shipped to the market I should say there must have been 10 to 20 per cent of it containing larvæ or pupæ, either in the corn or in the butt. But as far as the injury to that farmer is concerned, he did not lose a cent because the consumer lost it. His corn went to the market and sold as early corn at the same price as other sound corn. Of course the consumer was the loser.

That was at the end of August, 1918. From 10 to 20 per cent of the ears or of the butts or stems of the ears was infested. The damage to an ear of corn infested by this insect rarely exceeds the damage occasioned by the ordinary corn earworm. The exhaustive studies of the latter insect by Dr. Quaintance indicated a loss of 7 per cent to the infested ear in actual grain. Seven per cent of 20 per cent gives you 1.4 per cent actual loss in grain, and that is taking the highest estimate given by Mr. Vinal and making no deduction for the worm in the butts! The possibility of even such loss to corn makes the insect important, but it does not indicate doom to the corn crop of America! I think I can say fairly that I have seen certain fields, two or three, in Massachusetts in 1919, which have shown damage equal to that mentioned by Mr. Vinal, if not exceeding it. Here again we want to get all the information possible and to give such information proper weight.

The factor of number of broods or number of generations which this insect may have annually is, therefore, of great importance. Wherever the insect is double-brooded the damage will undoubtedly be greater. In coastal New England the double-broodedness is apparently due to the influence of the Gulf Stream. The New York climate, however, in both the eastern and western areas invaded, carries over a good deal of the important northern half of the corn belt and single-broodedness can be reasonably anticipated over most of that area.

The second hopeful feature is the substantial immunity of field corn indicated by the experience of 1919. In his reference to this factor, Dr. Felt failed to note that the corn crop of the large area in western New York is practically all the common coarse field corn. In this area the insect has been confined to the stalk and is so rare that our records indicate about one fifteenth of a worm to the square mile! That is not eating up the corn crop, is it? The corn borer has un-

doubtedly been in this western New York area eight or ten years to have gained the existing spread and, therefore, the absolutely negligible damage to field corn in this large area is a very strong support of the immunity of such corn.

The third point which I wish to make is the strong indication that clean culture will very largely limit damage by the corn borer. In Massachusetts, where the insect is doing its greatest damage and where it is double-brooded, the worst fields were weedy fields or fields surrounded by weedy areas. The general weediness throughout the Boston area has undoubtedly very much increased the abundance of this corn borer. I do not want you to take my dictum only on that factor. I wish to read a statement from Mr. Worthley who goes vigorously into this subject. It was made at the hearing in Boston last August and is as follows:

> We made a special examination for this hearing of fields and we found especially in celery fields a great amount of weeds. We would like to plead with the market gardeners as evidently it must be a good crop to try to keep the weeds down as near as possible and help us in control measures. One of the celery fields I visited recently is worth probably $100,000. While we found no borers in the celery, we found them in weeds right adjacent to the celery. They have a large force of men working on the place and for a couple of hundred dollars they could have cleaned up those weeds and there would have been no borers. It seems to me with the large amount of money involved in these market garden crops, a small percentage might be laid aside to keep the weeds down and this will help the work just that much more. I hope the members of the Market Gardeners' Association will appreciate that and that will make our money go much farther.

In response to this, Mr. Ballinger, representing the Market Gardeners said:

> The gentleman who has just spoken has brought up the subject of weeds. . . . He wants us to keep the weeds down. Where can we get labor? It is easy enough to say that but where do we get the labor? . . . It is practically within the same period that the borer has been in existence that the farmer has been short of labor. We all know that we have had more weeds during that time than at any time before.

The several commissions that I have mentioned have all noticed the weed factor and that the fields worst damaged were either weedy or surrounded by areas of weeds. The gardeners and commission men at the hearing in question pointed out that this condition had been particularly bad since the war. The inability to get labor has resulted in general neglect of headlands and vacant fields and lots and roadsides. Often labor has not been available to weed out even the planted fields. Many of these weedy areas are even worse attacked than cornfields. The corn borer works not in some fifty plants, as mentioned by Dr. Felt, but in a hundred different plants, as now known, and the small patches of sweet and flint corn in the Boston area have

apparently attracted the insect from the surrounding weeds and thus become worse infested. Clean culture, therefore, may prevent much of this loss.

The fourth helpful factor is the effective work on the second brood in Massachusetts in the season just passed of the egg parasite, *Trichogramma minutum*. It is possible that this parasite cannot always be relied upon, but with respect to the second brood in 1919, this egg parasite, on the authority of Mr. Caffrey, destroyed some 43 per cent of the egg masses as a whole, and in some fields parasitism reached 75 per cent.

As decidedly hopeful factors, therefore, we have (1) for the northern areas of corn culture, single-broodedness with accompanying negligible damage indicated; (2) possibility of cultural control by the elimination of weeds; (3) the immunity now indicated for ordinary field corn, and (4) the possibility of effective egg parasitism. All these factors should be taken into consideration in estimating the future importance of this insect as a basis for determining what appropriations we should ask of Congress for control work, also the other factors of distribution, food plants and cost, as affecting any program looking to possible extermination.

Before discussing what can be done in the way of control work, including prevention of distribution, I wish to refer again for a moment to the subject of extermination. I hope we have all given up the idea of extermination, at least with the exception, perhaps, of Dr. Felt. No one would like to see the corn borer exterminated more than the speaker, but suppose I do not give you my opinion at all (laughter), but instead let you have the judgment of the experts who have been working with the corn borer longest and know most about it. I have here a statement made by Mr. Caffrey, who has been studying this insect intensively for some three years and perhaps knows it better than any other person. At the hearing in Boston last August he was asked whether the corn borer could be exterminated. He replied "I think the statement was made that if we had unlimited funds and unlimited authority it could be done. I think that covers the ground." He goes on "I cannot imagine any condition under our democratic system of government in the United States where we could realize these conditions. It would amount to giving us authority to go into any man's property and if we found a few in his celery, or a few in his weeds, or corn, to dig up everything and keep everything out that year and possibly the next." He was asked "How would you get distribution?" He replied "That would depend upon your funds. If you had unlimited funds you could, if necessary, put a couple of million men in the field to examine every stalk." In the same connec-

tion Mr. Worthley advised me that there are 20,000 miles of roadway in the old 400 square miles of area in Massachusetts. To go over those roads is equivalent to a trip seven times the distance from Boston to San Francisco! Those roadways are more or less lined with weeds and are bordered with private estates. There are over 300,000 of such estates in the old limited area in Massachusetts and the added area now increases these many times. The insect breeds in 100 different plants. If we cannot determine distribution except by the employment of 2,000,000 men examining every weed, we have no right to spend millions of dollars in efforts at extermination here and there, only to find that the insect occurs all around us. We should have wasted that money. I do not think anything more needs to be said on the subject of extermination.

Practical control work is, however, another matter. The discussion of legitimate control work with respect to the corn borer brings us to the subject of state and federal quarantines. The Federal Horticultural Board was early requested to quarantine the invaded territory in Massachusetts. Such quarantine was established covering the then known infested district with respect to corn. Following the determination of the wider spread of the insect and its discovery in New York, additional hearings were called for the purpose of extending this quarantine both as to district and subject. At these later hearings the officials of Massachusetts and New York were less anxious to have federal quarantines and requested that the matter be left in their own hands. Various reasons for this were urged. A federal quarantine being limited to interstate control would, in a sense, cover the whole state and would put a sort of blight on the state. I cannot go into the full argument. At any rate we yielded to it but only upon the agreement on the part of the representatives of the states of Massachusetts and New York that quarantines would be promulgated by these states that would prevent movement out of the infested territory of any products likely to carry the insect. Such quarantine orders were shortly thereafter issued by the Commissioners of Agriculture of Massachusetts and New York. The quarantine in Massachusetts has been extended five or six times, but has remained as applying to corn only. The New York quarantine has not been extended to cover the new areas of infestation. There was perhaps excuse for not promptly extending these quarantines. New territory and new food plants were being determined so rapidly that quarantine action could not well keep up with this increased information. Every day added a new township or a new county. The knowledge that the broom corn, that had probably brought the insect to Massachusetts and New York, had been widely distributed throughout the middle

west gave a broader viewpoint and indicated that there was every possibility that the insect was widely distributed throughout the eastern half of the United States. Another important consideration was urged with respect to a federal quarantine, namely, that it would interfere with the necessary movement of food products. The absolute need in the case of several New England states of the food articles which would have to be controlled as to Massachusetts was clearly brought out at our hearings, and commissioners and other representatives of these states asked us not to place general quarantines because of these needs. The situation, therefore, is practically this: Are we justified, because we have been clothed by Congress with authority, in placing very hurtful restrictions on large areas of the country on account of what may perhaps be, after all, an unwarranted fear? Are we justified in taking such action, with the evidence indicating that the insect has been very widely distributed, before opportunity is offered for the determination of such distribution and with the area being constantly added to?

If we expect to be listened to and have our requests granted, we have got to take a sane viewpoint of the situation and present such viewpoint. We cannot, in justice to ourselves, put our heads under the sand and say we won't see these conditions, and go ahead with the idea that the corn crop of the country is doomed unless we begin at once to exterminate the insect.

I asked Commissioner Wheeler at one of these hearings how he proposed to exterminate the borer. His answer was substantially "Perfectly simple. Begin at the outer edge and push it into the sea." That is the easiest thing in the world to say, but a very different thing to do. He tried pushing the insect into the sea with his own funds and, in spite of the fact that we have been told that that clean-up work resulted in a lot of good, I have here statements from competent observers that it was practically of no value.

Mr. Caffrey at the Boston hearing in August, 1919, made the following statement:

> As a result of the clean-up work which was done last year we rather hoped that the degree of infestation would be reduced but we find that right within the area that was commonly supposed to be heavily infested that the plants are infested to a greater extent than they were last year.

Mr. C. G. Woodbury, head of the Indiana Commission, in his report, says:

> Much clean-up work has been done at state and federal expense in this territory; the effectiveness of such work is questionable. There are fields which were not cleaned up last year but which nevertheless have a much smaller infestation of borers this year than last. On the other hand, there are certain fields in which as high as

$75 per acre were expended in clean-up work in which the borers apparently were more severe this year than they were last year.

I wish here to insert a word to correct a misapprehension which seems to be widespread with respect to the alleged delinquency of Congress and the consequent wide extension of the corn borer. It has repeatedly been intimated that the corn borer extended its range to many times its area of last year because Congress did not give immediately the sum of $500,000 for exterminative work. The facts are that the first estimate submitted to Congress—and the amount was only $25,000—came before the Agricultural Committee for discussion in a hearing on January 8, 1919. As a result of a special hearing, February 12, 1919, on the European corn borer by representatives of several states, there was inserted in this same bill in the Senate under date of February 22, 1919, an item of $500,000 to meet the corn borer emergency and the $25,000 item for the bureau was dropped. The various exigencies which prevented action on this appropriation bill and also prevented the securing of a like appropriation in an emergency deficiency bill before the 4th of March were due to post-war conditions in Congress which affected all legislation.

No hearings on the Agricultural Appropriation Bill for 1917–20 were held by the succeeding Congress but the Secretary of Agriculture submitted a memorandum recommending that both the item for $25,000 for the Bureau of Entomology and the special item of $500,000 for control work be included. As eventually passed by the succeeding Congress, July 24, 1919, the bill carried the appropriation originally requested, of $25,000, and a special appropriation of $250,000. These two appropriations are now carrying on the work. The most, therefore, that could have been gained by an immediate action of Congress would have been an availability of this fund for work in 1919 prior to the season for planting crops, the same sort of work which was actually conducted under state funds over much of the area with results which have already been discussed. It is utterly illogical to represent that the insect spread over all the new area now known to be invaded because Congress did not immediately give $500,000. The facts are as already indicated that the spread of the insect has been a slow ten-year process and there is nothing to indicate that the spread of 1919 was essentially more rapid than it had been during the previous year or years.

Our position with respect to this appropriation, I think, has perhaps been sufficiently set forth. We could not with our information ask Congress for huge sums for exterminative work which we believed to be impracticable and impossible. We could and did represent to Congress that we had here a new corn pest that had shown enough

damage in Massachusetts to indicate its importance and that we wanted sufficient funds to determine such importance and whether it could be controlled and incidentally if there was any possibility of extermination, and that we wanted to take quarantine action to prevent spread. To accomplish this general purpose we inaugurated a program of survey work which has now been stopped by the winter but to be renewed with increased vigor next season. Then we wanted to test the possibility of intensive control in an area large enough to make the results significant. This project is now being carried out in an area including half a dozen townships in Massachusetts. When this area was selected, it was a section running from the outer border of the infestation inward so that it would be a real clean-up as far as it went. It is true that later discoveries of distribution have made this area more or less central but the methods which are being developed and the results which we hope to gain will be valuable as indicating the possibilities of such intensive control. No one imagines for a moment that we are going to exterminate the corn borer in that area—that is, anyone who really appreciates what extermination demands.

In concluding, I wish to repeat and emphasize what I said at the beginning that as technical men with reputations worth keeping, and if we expect to be listened to and to have our opinions given any weight, we have got to keep away from ungrounded theory and make our recommendations in terms of common sense. In other words, steer clear of what anyone will recognize as impracticable and hold only to what can be shown to be possible of reasonable accomplishment. We have got to have intelligent basis for our recommendations and we believe that such basis can be obtained by an additional appropriation at this time of $500,000 which with the other funds available will make $775,000 for the corn borer for the seasons of 1919 and 1920. If the results of this work, which we look upon as fundamental and necessary for the right appraisement of the problem, should indicate the need of larger appropriations, we will then be in position to intelligently present such need to Congress.

MR. E. D. BALL: I have been very much interested in the two discussions of the corn borer, and also very much interested in what I saw of it in the fields, but it seems to me that what we need now is a fundamental viewpoint in this matter. This is either an injurious insect which is going to be more or less of a menace to the corn crop, or else it is not. If it is not an insect that is going to do any injury to the corn crop, and is not a menace, then neither the states nor the government is warranted in putting any money up to fight it. If it is an injurious insect every possible effort should be made to control it

because we know enough about it to know that it will be difficult or impossible for the farmer to fight it.

We have heard today that it is an injurious insect and we have heard that it is not an injurious insect. Our friend from Indiana who went down and looked over the situation reported that it did no damage, and then he went back to Indiana and recommended that they put on a strong quarantine for fear it would get into Indiana. (Laughter.) That was one of the most beautiful pieces of contradiction that I ever saw in American literature.

We heard conflicting stories at the Boston meeting as we are hearing them today but we saw enough of its damage to be satisfied that if this insect gets into our canning regions, and apparently it is driving in that direction, it will put a very great damper on the canning industry. The corn worm is bad enough, but it comes in from the outside and you can see it and cut it out, but a worm that bores into the stalk and up into the ear from the inside will do more damage. Three or four caterpillars ground up and turned out in a can of corn will not make a very desirable dish.

If we have determined that it is an insect that will do an appreciable amount of damage then we want to know whether it is possible to fight it in any way? Can its spread be stopped? The question of spread is a matter of great importance. What you do this year is worth ten times what you do ten years from now or five years from now. (Applause.) While I recognize the value of thorough and extensive scouting, we know that the history of every effective piece of control work along these lines in this country has been a history of scouting followed up immediately by *action*. Of what value is all of the scouting that you can possibly do in the whole United States if it is not to be followed by anything else? The fact remains today that the state of Massachusetts and the state of New York in good faith put up $100,000 or more apiece to undertake to hold this thing in check and to eradicate it; that up to the present time the United States government has not spent a dollar nor done anything that is intended to prevent the corn borer from spreading to the great corn district of the west. The only money they have spent on eradication or control is being spent inside the infested area in Massachusetts which is of no value in holding it from the west.

We of the corn belt are interested primarily in the western extension and spread of this insect into New York and Pennsylvania, because if it is to be kept out of the corn belt, there is the place to spend the money first. If they can make a success of eradicating that slightly infested area, then they might be warranted in spending money in Massachusetts. If they cannot make a success of that, then there is

no use spending large sums in Massachusetts. The western frontier is the place to begin because there is where the battle will be won or lost. If the government representatives honestly believe that this insect cannot be controlled we will all respect and admire them if they will stand up and say so. We will then know what to do next; but as long as we cannot get a statement of policy, we are very much handicapped. We would like to know what the government is really and seriously intending to do about the corn borer. The great corn center of this country is vitally interested in that question.

MR. E. P. FELT: It seems desirable to correct one or two impressions. I am very well aware that one can go into the European corn borer territory either in New York or Massachusetts and find a variety of conditions, many diametrically opposite. It is not the conditions but what they signify which is really important. It is my impression that Dr. Marlatt has not correctly estimated, presumably unintentionally, the infestation in western New York. There are fields in that section where it is comparatively easy to find several hundred borers per acre and generally speaking it is not difficult to draw the line between infested and uninfested territory. This does not harmonize very closely with figures given above and tending to show a very sparse infestation. The discrepancy simply illustrates the necessity of interpreting data and making due allowances for the conditions under which they were obtained. We found last spring that we could go into a section and approximate the infested area very closely. This was done during midwinter and fortunately operations were greatly facilitated by a remarkably light covering of snow. Eight or ten inspectors of the Department of Farms and Markets, working under such unfavorable conditions for three or possibly four weeks, established the approximate boundaries of the infested area. The findings of that time, it is a pleasure to state, were largely justified by subsequent developments.

From my knowledge of the New York areas I feel that there are moderately definite limits to the infested territory in both the eastern and western portions of the state and that it is practical to follow up the general line of work undertaken last spring and keep the insect down to a minimum in an effort to check its spread to other sections.

It appears unsafe to assume that it may be found in other parts of the country. We cannot say that it does not occur in remote areas and on the other hand we fail to find in this possibility a justification for relaxation in effort or a material modification of policy.

The situation in New York state with its limited injury is such that it is impossible to obtain a large appropriation for clean-up work because the matter is of more importance to other states than to New

York. In other words, residents of the corn belt must look to the federal government for this protection.

MR. C. L. MARLATT: May I venture to say a word on the policy or plan of work of the department concerning which there seems to be a feeling that such plan is indefinite or unannounced. I have attempted to indicate such policy and have apparently failed and may have no better luck this time. The policy of the department has been frequently outlined. Dr. Howard gave in detail our plan of work in August at the meeting in Albany. It is printed in the report of that meeting. Similar statements have been presented repeatedly to Congressional committees in the Senate and House. These statements have also been printed. This policy or plan of work was included in general terms in Dr. Howard's annual report for 1919 and also in my report for the same year as chairman of the Federal Horticultural Board. Apparently these statements of policy have not been understood or have been ignored.

The policy of the department takes into consideration the probabilities of the wide distribution of the insect, its hundred odd food plants and the possibilities of control of spread and of practical clean-up work. We realized the business viewpoint which Congress would take of the matter and the necessity of demonstrating the possibilities of accomplishment before such appropriations as were discussed at the Albany meeting could possibly have any status. At this meeting at Albany an appropriation of $10,000,000 or more was seriously considered but as a result largely of representations urged by me was finally brought down to $2,000,000.

To repeat it again, the program and policy of the department is to make as promptly as possible a thoroughgoing investigation to determine the actual necessities of the case and the possibilities of control. The first consideration under this plan is the determination of the distribution of the insect; second, to demonstrate on a large scale what may be done to control it; and, third, to coöperate with the several states in quarantine and other measures to prevent spread. A study of the insect to determine its importance and the biological factor is under way as you know and will be pushed to the utmost. We believe that this preliminary work can be fully carried out on the funds indicated, namely, $775,000. Until we have determined these fundamentals, we are not in position to appeal to Congress for vastly larger sums. This in general is our program and it has been repeatedly stated.

I quite agree that in a program of this kind the sooner the needs can be determined and practical work can be instituted the better. In practically all similar problems, the securing of adequate informa-

tion and determination of a plan that has promise of success have been the preliminary steps. This was done in the case of the citrus canker and pink bollworm but these were subjects limited to a single host plant and the problem was comparatively simple. The corn borer is on an entirely different basis. With respect to the delay, it must be remembered that the corn borer has evidently been in this country for some ten years and that the risk of spread is now much lessened by protecting quarantines which can be and will be strengthened.

MR. W. E. BRITTON: I do not want to criticize, but I would like to ask why no scouting will be done in the Mississippi Valley this year. I realize that a careful examination cannot be made in all of that territory, but it seems as though some scouting could be done during the winter. It might be possible to determine whether the insect is present. It might be found and that would change the plan of work for next season, and possibly save considerable time.

MR. C. L. MARLATT: The corn borer work for the bureau is in the hands of Mr. Walton and the scouting is under the direct charge of Mr. Worthley. The reasons for discontinuing scouting I have already given in part. These are largely unfavorable winter conditions and the economical use of funds. It seems much more desirable with the funds as they now are to continue the work next summer when the insect will be more easily discoverable. In practically all the new territory the insect is so extraordinarily rare that it is very difficult to find it in the stalks under winter conditions and it will be easier perhaps to detect its early work in the tassel next summer. It is largely a matter of using the men and money to the best advantage. Furthermore, we are limited as to funds. The $500,000 additional appropriation has not yet been granted.

Adequate quarantines, together with such field and district control as is practicable, are the important means of preventing wide jumps by the movement of infested products. In such quarantine work the states of New York and Massachusetts started valiantly but they have not lived up to the promise which this start indicated, a condition which has only recently come fully to the knowledge of the board. This situation will probably necessitate a federal quarantine and in fact a notice of hearing for such quarantine has already been tentatively drawn. The reasons for not taking federal action supplementing the original quarantine as to Massachusetts have already been explained.

MR. GEORGE A. DEAN: I have been very much interested in what has been said about the introduction of broom corn. Is there any way of determining whether the shipments were made in the Mississippi Valley? I think some of the states have funds with which they

could do their own scouting. I think it would help if we knew where this broom corn was distributed.

MR. C. L. MARLATT: Mr. Harrison E. Smith, in Mr. Walton's service, has had charge of the investigation of the distribution of this broom corn. Two shipments were traced as far west as Iowa. We do not know where the great bulk of the shipments went except that they were variously distributed in the Mississippi Valley. We knew of some points where this broom corn was used. It is a matter of considerable time to find these records buried in various business houses. In the case of the pink bollworm, we have been two or three years tracing the distribution of the Mexican cotton that entered in 1916. It takes time to do such work.

MR. J. G. NEEDHAM: Mr. President, it seems to me that our want of agreement over the policy of the Bureau of Entomology with respect to the European corn borer grows not so much out of any difficulty of understanding that policy (for it is clear enough), as it does out of the fact that that policy seems not to cover one point about which a good many of us are a bit apprehensive. It seems to omit all thought of checking the invasion at its front. Scouting and all the rest are well enough—none of us wish to curtail these activities, but should we be content with scouting and study while the invader is extending its range?

The corn borer may ultimately prove to be a blessing in disguise, like the San José scale and the boll weevil and the other imported pests with which it has been compared here today. But it may, like these also, for a time seem more like a devastating fire, able to sweep an important industry before it over a considerable area of our country. Shall we let the fire alone, taking chances in its doing little harm? That is the question. If not, it would seem that the place to fight it is where it is advancing farthest and threatening most harm for the future.

Owing to the sudden discontinuance of the electric current, the session adjourned in the dark.

Report of the Section on Apiculture

Wednesday Evening, December 31, 1919, 8.20 p. m.

The meeting was called to order by Chairman W. E. Britton, who presented an address entitled, "Some Phases of Beekeeping in Connecticut."

SOME PHASES OF BEEKEEPING IN CONNECTICUT

By W. E. BRITTON, *State Entomologist, New Haven, Conn.*

The state which I represent, Connecticut, is a small state, having an area of 5,004 square miles, and a population in 1910 of 1,114,756.

It has approximately 100 miles of sea coast and its highest altitude is Bear Mountain in the northwest corner, 2,355 feet. In this small area there are twenty cities, and twenty other towns have each a population of over five thousand.

Within the state there is great diversity of soil and climate. The waters of Long Island Sound exert an equalizing influence upon temperatures, so that along the coast, there are no such extreme high and low temperatures as are recorded inland. Though there are seldom tornadoes or blizzards, such as occur in the middle western states, there are constant and often abrupt changes in temperature. Mark Twain once remarked that there is no weather in New England—nothing but samples. Though the average rainfall is about 47 inches, there has been an excess of fully six inches the past season, interfering considerably with honey production.

Native vegetation and cultivated crops are as diversified as the climate. There are small forest areas and a large proportion of cut-over woodland, covered with brush. Farms are thickly scattered all over the state, and apple orchards are well distributed. In certain sections, peach growing, tobacco growing, truck crops, seed growing, floriculture, predominate—in fact, all lines of agriculture and horticulture suitable to the climate are carried on in Connecticut. There is also considerable so-called waste land with growth of wild plants, like sumac, which furnishes pasturage for bees.

Streams, lakes and reservoirs are sufficiently numerous and well distributed so that seemingly bees would never lack for water. Connecticut is, therefore, a fairly favorable place to make honey and markets are right at home.

Very little was known about the beekeeping industry in Connecticut prior to 1910, when the first inspections for bee diseases were made under the law enacted by the preceding legislature, though a state beekeepers' association had then been in existence for several years.

There are on file in my office the names of 2,571 beekeepers who own some 20,000 colonies of bees, but we have reason to believe that there are many more of which the inspectors never heard. I am sure that there are more than 3,000 beekeepers. One of the chief difficulties encountered by the inspectors is to learn who are keeping bees and where the apiaries are located. The Connecticut Beekeepers' Association originated a bill which was introduced into the last session of the legislature providing for the registration of beekeepers with the town clerk in each town where the bees are kept. This measure became a law in the following form:

SECTION 1. Every person owning one or more hives of bees shall, annually, on or before the first day of October, make application to the town clerk of the town in

which such bees are kept, for the registration of such bees, and such town clerk shall issue to such applicant a certificate of registration upon the payment of a recording fee of twenty-five cents, which certificate shall be in the form prescribed and upon blanks furnished by the commissioner of domestic animals and shall be recorded in the office of such town clerk.

SEC. 2. A record of such registration with the name and place of residence of the registrant and the definite location in the town where bees are kept by him shall be recorded in a separate book in the office of the town clerk, which records shall be accessible to the public.

SEC. 3. Any owner of bees who shall fail to register as required by the provisions of this act shall be fined not more than five dollars.

The winter of 1917–18 was very severe in Connecticut and many bees died. Some beekeepers lost all their colonies, others only a part. Not only were honey bees killed, but the native bees of *Andrena*, *Halictus* and allied genera are believed to have winter-killed as they were extremely scarce the first part of the summer of 1918. In addition to the scarcity of bees in orchard blooming time, the temperature was so low that the few bees surviving the winter could not work the flowers. Consequently, except in a few localities, there was a poor set of fruit, especially apples. The peach buds were nearly all killed anyway.

As the effect of the winter was so severe on bees, all beekeepers were urged to protect the hives during the following winter, 1918–19, which as you know, was very mild and bees would have wintered nicely without protection. Nevertheless, after the protective covers have once been made it costs very little to put them on and they should be applied every season as an insurance. It is always advisable to safeguard the welfare of each colony.

The inspection service was first established in 1910, and has been in effect just ten years. At first the inspections could be made only on complaint or request. Most interested beekeepers were willing to sign the papers to have their own apiary inspected; this defect in the law was remedied by the legislature of 1913, and since then the inspectors have had authority to inspect bees anywhere within the state without requests or complaints. The chief hindrance to the inspection work has been the small appropriation, but the last legislature has increased this to $2,000 annually.

It is interesting to note that when the first inspections were made in 1910, European foul brood was abundant everywhere, more than 75 per cent of the apiaries, and nearly 50 per cent of the colonies being infested. Though only a portion of the apiaries have been inspected each year, there has been a gradual decrease in European foul brood until 1919, when only 6.6 per cent of the apiaries and 1.2 per cent of the colonies were infested. Though it is possible that the disease has

diminished in virulence, this result, I believe, may be fairly attributed to the inspection service and particularly to the extension work done by the inspectors in showing the owners how to recognize the disease and how to eradicate it. The percentages for each are as follows:

PERCENTAGES OF EUROPEAN FOUL BROOD IN APIARIES INSPECTED

Year	No. apiaries inspected	No. colonies inspected	Percentage infested, Apiaries	European foul brood Colonies
1910	208	1,595	75.9	49.7
1911	162	1,571	51.8	27.4
1912	153	1,431	47.7	23.5
1913	189	1,500	44.4	24.5
1914	463	3,882	32.6	13.9
1915	494	4,241	26.1	10.3
1916	467	3,898	18.8	7.05
1917	473	4,506	16.7	4.86
1918	395	3,047	9.8	3.3
1919	723	6,070	6.6	1.2

The occurence of American foul brood has, of course, been sporadic. It has been mostly in the southern part of the state, and there was more of it in 1919 than in any year since the inspection service was inaugurated. The record of percentages for this disease for the ten-year period is as follows:

PERCENTAGES OF AMERICAN FOUL BROOD IN APIARIES INSPECTED

Year	No. apiaries inspected	No. colonies inspected	Percentage infested, Apiaries	American foul brood Colonies
1910	208	1,595	00	00
1911	162	1,571	00	00
1912	153	1,431	00	00
1913	189	1,500	00	00
1914	463	3,882	1.07	.7
1915	494	4,241	.8	.18
1916	467	3,898	1.07	.15
1917	473	4,506	.42	.17
1918	395	3,047	1.01	.32
1919	723	6,070	3.0	1.1

We now have an extension worker in apiculture in Connecticut. With the right kind of demonstrations, exhibits, and many personal visits to apiaries, I believe that the future is promising for the business. Possibly it may be necessary to cultivate or encourage sweet clover or some other valuable honey producing plant, but this will come about as a direct result of aroused interest in the subject, and intelligent management of apiaries.

The value of local organizations in stimulating interest should not be overlooked. A county association was organized in Fairfield County in October, 1918, and Professor Watson, who was then the extension worker with bees, told me that he should not be content until he saw a live organization of beekeepers in each county of the state. Professor Watson has since gone into the Bureau of Entomology, and his successor, Prof. L. B. Crandall, is just beginning his work in the state, and though I have not conferred with him on this point, I am certain from the tone of his paper prepared for this meeting that he will leave no stone unturned to promote the interests of beekeeping within the state.

I have mentioned these conditions in connection with my own state, but no doubt they are common to other states. The welfare of the business demands better beekeepers rather than more of them. With most beekeepers in Connecticut, the keeping of bees is not the chief business but is only a side issue. The few colonies in the average apiary are not enough to warrant a large outlay in time or equipment, and in many cases they do not receive proper treatment. It is believed that the registration of beekeepers, more money for inspection, and the right kind of extension work will make for more intelligent management, and prove a great benefit to the business as a whole.

CHAIRMAN W. E. BRITTON: We will now listen to a paper by Mr. Frank C. Pellett.

MR. F. C. PELLETT: It was accident rather than intention that two subjects were assigned to me on the program. I shall present only one. I might say, incidentally, that Boys' and Girls' Bee Clubs was a subject I chose last year, and I expected to give an outline of some of the things I had observed in localities where such clubs existed.

In Kansas, where a demonstration agent introduced this, especially in the localities where there were no commercial beekeepers, he required parents of each boy or girl who became a member to have bees and they were also required to furnish the club member with the proper equipment for transferring them. One thing especially which attracted my attention was the fact that one farmer made a good deal of fun of one of these boys for taking up these newfangled notions. In the fall of the year, the boy had more honey to sell from his two cells than the farmer had from fifty. The boys' work prospered in that locality from that time on.

My paper is entitled "Adapting System to Locality."

ADAPTING SYSTEM TO LOCALITY

By FRANK C. PELLETT

Locality is a badly overworked word in our beekeeping literature.

It is too often used to explain away differences of opinion due to careless observation or improper manipulation. While differences in bee behavior are not usually to be credited to locality, a different system of manipulation is often necessary to make the most of the flows arising under different conditions.

Doctor Phillips and his staff have brought forcibly to the attention of the beekeepers, through the medium of the short courses recently so popular, that the fundamentals of beekeeping are few and easily grasped by the intelligent mind. Room, stores and protection have been shown to constitute the essentials which must be recognized under any conditions. With a proper understanding of these, it then becomes important that the beekeeper study his individual location in order that he may apply his knowledge to bringing his colonies to the peak of brood rearing in time for the principal harvest of the year. In this connection a brief consideration of the peculiar conditions to be met in different parts of the country and the effect upon the plans of the beekeeper may be of some interest.

In southwest Iowa, where the writer kept bees for several years, there was but one principal honey-flow—from white clover. This flow lasted from ten days to six weeks. If the bees were not ready when the flow came there was little chance of securing a crop from a later flow. Usually there was sufficient fall flow to fill the hives and put the bees into good condition for winter, but no surplus worth while was secured. In a location like that the beekeeper must bend every energy of the entire year to bring his bees to maximum strength at the beginning of June and to prevent swarming till the brief flow is over. If the bees winter poorly there is little time for coddling them and building up weaklings to profitable strength. Good wintering is essential. It is also important that no time be lost in building up the colonies in spring. It was found that, by wintering the colonies in two stories with the upper brood-chamber well filled with honey, it was usually possible to turn the surplus of food into young bees and have the two stories well filled with brood and bees by the close of fruit bloom, always providing that the bees wintered well. With careful attention it was possible to get from two to four times as much surplus as the average farmer with bees in the neighborhood was able to secure. There was seldom a season when it was possible to make increase ahead of the honey-flow to any extent, without reducing the crop.

In contrast to this location there are places in the alfalfa districts of Colorado where the main flow comes in August, where it is the practice to make increase from the early flows and still have the bees in good condition for the principal flow. There, some beekeepers practice wintering in two stories and, as soon as the two stories are filled with

brood in spring, the upper story is removed and given a ripe queen cell. With the late flow it is possible to have two colonies instead of one for the gathering of the crop. In a situation of this kind, poor wintering is not nearly as disastrous,—providing, of course, that the bees come through alive,—as it is where there is only one flow and that very early.

In the vicinity of Washington, D. C., tulip-tree, often spoken of as "poplar," is the principal source. Because it blooms so early that the bees are seldom ready for the flow, the vicinity is generally regarded as a poor location for beekeeping. Yet an average of something like 100 pounds of surplus honey per colony is gathered at the government apiary where careful wintering is practiced.

In the lower Rio Grande Valley of Texas there are frequent flows from many sources. These flows are likely to come at almost any time after a rain. Heavy flows are infrequent and, light flows coming so often, it is difficult for the beekeeper to harvest much surplus, since the honey is largely consumed in the almost continuous brood-rearing. The writer found the bees to be very strong in well-kept apiaries in early March. There were reports, also, that bees sometimes swarmed as late as December and found sufficient support to carry them through. In a location like this, commercial honey production is less profitable than the production of bees and queens to supply the demand of northern beekeepers. In north Texas, at Waxahachie, local beekeepers report that the bees are ready for business by April, yet the main flow does not come till June. They find it very difficult to keep down swarming during the intervening period. One man, T. W. Burleson, has solved this problem by selling his early bees in packages and still giving his colonies time to build up for the honey-flow from cotton. Until the demand for bees developed he found great difficulty in overcoming the swarming problem.

In such locations beekeepers often are very indifferent about giving attention to wintering. They say that no matter how weak the bees are in spring, there is still time to build up in time for the flow and that strong colonies in early spring are of no particular advantage.

There are other factors beside the time of the honey-flow that enter into the consideration of locality. The source and nature of the flows also determine to a great extent the system which is best suited to the conditions. Comb-honey cannot be produced to advantage except under specially favorable conditions. A slow or intermittent flow will result in poorly finished sections and a short crop, where a good crop of extracted honey might be secured. In some sections of Colorado there is much gum-weed (*Grindelia squarrosa*), which granulates very quickly, sometimes even before the honey is sealed. Where this honey is mixed with the alfalfa, granulation is sure to follow within

a short time and as a result the comb-honey market gets a black eye. Granulated comb-honey is a drug on the market and in such a situation extracted honey only should be produced. At least comb-honey supers should be replaced with extracting supers during the flow from gum-weed. Enough of this gum-weed alfalfa mixture has gone to eastern markets to create a prejudice against Colorado comb-honey in some places.

In several of the southern states, bitterweed (*Helenium tenuifolium*) is quite common. The honey is absolutely unpalatable and should never be placed on the market. Even a small quantity of this bitter honey is sufficient to spoil a whole tankful of good honey. There the beekeeper should remove all the good honey from the hive when the bees begin to work on bitterweed and give them empty supers of extracting combs. When the flow is over, if other flows are still to come, the bitter honey can be taken off and the other supers replaced. When the season is over, the bitter honey can be given back to the bees for winter stores. No adverse reports have been found from the use of bitter honey for wintering the bees.

The available pasturage determines the number of colonies that may be successfully kept in one yard and this in turn influences the system of management. In north Georgia there is a large area where not more than twenty-five colonies are profitable in one apiary. There is a variety of sources of nectar available but not enough of anything to support a large number of colonies. One beekeeper in that region keeps 800 colonies of bees, in thirty yards. This requires a large amount of travel, but his returns are more nearly constant than in any other locality with which I am familiar. In contrast there are numerous locations in the sweet clover districts and some in the buckwheat regions where three hundred or more colonies do well in one location.

The presence or absence of a supply of pollen for brood-rearing is also an important factor. In some places, where there are heavy flows, pollen is scarce and the beekeepers find it necessary to take the bees elsewhere to build up. This requires long distance moving which is tiresome and expensive.

The dependability of the forage is also to be considered. There are many places where good crops can be gathered occasionally, with frequent seasons of failure. This necessitates migratory beekeeping if the apiarist is to harvest a crop every year. There are numerous California beekeepers who make long moves from once to three or four times in a season, moving to such locations as promise an immediate harvest. This is practiced to a lesser extent in some of the central and eastern states. The Dadants find it frequently to their advantage to move their apiaries to the lowlands along the Mississippi River

when the crop is a failure on the uplands. This requires a move of something like thirty miles, which can easily be accomplished in a day, with their big trucks.

The above examples could be multiplied indefinitely, but are sufficient to show how necessary it is that the beekeeper be fully informed as to the conditions peculiar to his location and that he develop a system of beekeeping best adapted to those conditions.

CHAIRMAN W. E. BRITTON: If there is no discussion, we will take up the next paper, "The Relation of Bees to Fire-Blight," by H. Å. Gossard. (Withdrawn for publication elsewhere.)

CHAIRMAN W. E. BRITTON: We will now listen to the paper by Professor J. H. Merrill, entitled "Preliminary Notes on the Value of Winter Protection of Bees," which will be read by Mr. M. C. Tanquary.

MR. M. C. TANQUARY: I am very sorry that Mr. Merrill is not here, because he has spent two years of work on this subject. I have tried to follow him more or less closely, as I was much interested in his work.

PRELIMINARY NOTES ON THE VALUE OF WINTER PROTECTION FOR BEES[1]

By J. H. MERRILL, *Apiarist, Kansas State Agricultural College and Experiment Station*

That a strong colony of bees will gather more honey than a weak one is a fact accepted by all experienced beekeepers. However, to gather more honey, this colony should be strong at the proper time in order to take the fullest advantage of the honey-flow. The proper time to have a colony strong is at the beginning of the honey-flow. If it becomes strong too early, it consumes stores which the bees have in the hive; if too late, it cannot assist in gathering the crop for that season. Whether or not the colony is strong will depend to a large extent upon how it passed through the winter.

Gates, 1914, gives some very valuable data on the temperature of the colony of bees throughout the year. Phillips and Demuth, 1914, give the results of some very careful observations on the temperature of a colony of bees in winter, and further explain in detail the actions of such a colony during the winter which are necessary in order to maintain a proper temperature. Phillips maintains that a bee may be compared to a storage battery in that it has a certain amount of energy to spend, after which it dies. He further says that the bee is

[1] Contribution No. 48 from the Entomological Laboratory, Kansas State Agricultural College. This paper embodies some of the results obtained in the prosecution of project No. 126 of the Agricultural Experiment Station.

obliged to resort to muscular activities in order to maintain the proper hive temperature. A system of winter protection which would minimize this expenditure of energy would result in a strong colony in the spring.

Phillips and Demuth, 1915 and 1918, give directions for preparing bees for the winter which will aid very materially in securing a strong colony of bees at the right time of the year. Although their explanations as to the need of winter protection for bees, and how to secure this should be satisfactory to all, there still remain a large number of people who either through mistaken observations of their own, prejudice, or on account of giving value to mistaken observations of others, will persist in refusing to accept even the clearest explanation if it does not happen to coincide with their preconceived opinions. This latter class of people are prone to maintain that these explanations may perhaps be facts, but they apply to some other part of the country than the one in which they reside. In order to convince them that these facts apply to their locality as well as to all other localities, and that these problems apply in every respect to them as much as to other beekeepers, it is often necessary to conduct additional experiments to prove further something which has been clearly explained before.

It has been the purpose of this experiment to gather data along the following points:

First, the comparative value of one-story and two-story hives for wintering; second, the importance of a windbreak; third, the comparative value of packed and unpacked hives for wintering; fourth, the amount of stores needed to last a colony until the honey-flow commences; fifth, the effect of climatic conditions on wintering; sixth, to ascertain what form of winter protection will insure the strongest colony of bees at the beginning of the honey-flow.

In order to secure data on these points, experiments have been carried on at the Kansas State Agricultural College since 1917. In the experiment, two sets of hives are used. One set is placed in an open exposed situation where it receives no protection at all from the prevailing winds, and the other set is placed in a very dense hedge windbreak, so that the strength of the wind is very materially broken before it reaches the hives. In each set there are three colonies of bees corresponding in every way with each other. That is, there is one one-story hive, one two-story hive, and one packed hive in each set. The packed hive is in a single packing case, with four inches of leaves beneath it, six inches around it, and eight inches on top, used as an insulation. The entrances during the winter months are contracted to one three-eighths of an inch auger hole. Each one of these six hives rests on a platform scale, and is not removed from its position throughout

the year. Daily readings are taken throughout the year of the weights of the various hives, and all changes in weight recorded each day. In order to determine the amount of honey that is in each hive, and the number of bees present, a general weighing of the colonies is made in the fall on the date that the bees are put into winter quarters. On the day that the honey-flow starts, another general weighing is made, to determine the number of bees which have passed through the winter and results of both the spring and the fall weighing are compared to secure the data desired. Briefly, the method of weighing is as follows:

Each colony is weighed early in the morning before any of the bees emerge. Next the weight of the hives without the frames is ascertained, and the weight of the frames with honey. From the weight of the frames of honey is deducted the weight of the empty frames, giving the amount of honey which is in the colony. We then know the weight of the hive, and also the combined weight of the hive and honey. This total, when subtracted from the weight of the hive, honey, and bees, gives the weight of the bees. Precautions are taken in recording these weights to prevent the bees from filling up with honey, thus making, according to the figures, a larger number of bees and smaller amount of honey than really exists in the hive. The process of weighing these colonies is rather complicated, usually requiring from three to four persons a whole day in order to weigh the six colonies in the experiment.

The number of bees in a pound has been variously estimated, but for the purpose of this experiment we assume that there are 5,000 bees in every pound. If this number is adhered to throughout the experiment, it will be as fair to one colony as to another. As stated above, the weight is recorded each day from each one of these hives throughout the year. In addition to these, the record of the temperature, the direction of the wind, and the strength of the wind for each day is also recorded in order that we may have an opportunity to learn what effect climatic changes have on the wintering of the bees. These colonies are brought as nearly as possible up to the same strength in bees and honey. The queens used in them are all from the same stock, purchased from a reliable queen breeder, and introduced into the colonies on the same day. Each colony is requeened during the month of August in order to insure a young queen to carry on the duty of the hive. The weighing which is conducted in the spring shows whether or not there has been an increase in the number of bees during the winter. It is considered that the form of wintering which produces the largest number of bees in the hive on the day that the honey-flow starts is the most successful method of wintering.

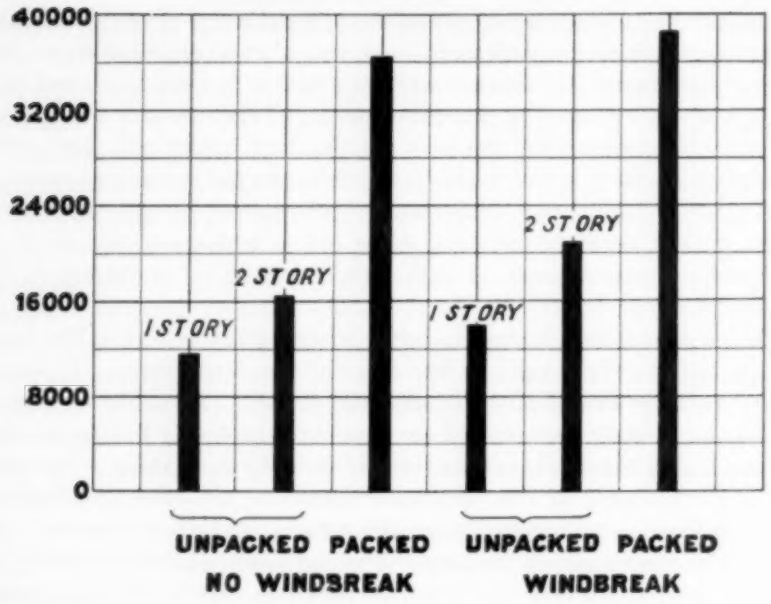


Fig. 1. Showing the number of bees at the beginning of the honey-flow, the advantage of packed over unpacked hives, and the value of sheltering with a windbreak.

TABLE I. NUMBER OF BEES AND FRAMES OF BROOD IN EACH COLONY MAY 4, 1919

Unsheltered—No Windbreak		
One-story	Two-story	Packed
11,718—3 2/3 frames	16,406—3 1/2 frames	36,718—4 1/2 frames
Sheltered—Windbreak		
One-story	Two-story	Packed
14,063—4 1/2 frames	20,936—3 3/4 frames	38,594—5 3/4 frames

COMPARATIVE VALUE OF ONE-STORY AND TWO-STORY HIVES

At first glance it would seem that bees would winter better in a one-story hive than they would in a two-story hive, since there is less space to keep warm, and consequently, they would not use as much energy as they would in a two-story hive. If the winter stores are properly arranged so that the bees will be in the upper hive body during the coldest part of the winter, the objection of extra room to be kept warm is largely overcome. Two of the requirements for good wintering, according to Phillips and Demuth, 1915, are, first, plenty of stores, and second, plenty of room for brood rearing. A two-story hive suits these conditions much better than a one-story hive would do.

Table I shows that in the spring the two-story hive in the open had 16,406 bees, while the one-story hive had only 11,718, or a difference of 5,688 bees. In the windbreak, the two-story hive had 20,936 bees and the one-story hive had 14,063, or a difference of 6,873 bees. This

shows not only the superiority of the two-story hive over the one-story, but also shows that the windbreak made a difference of 1,185 bees.

TABLE II. COMPARISON BETWEEN NUMBER OF BEES IN FALL AND SPRING WEIGHINGS

	1917–18	1918–19
No Windbreak		
One-story	−332	−3,282
Two-story	2,808	−469
Packed	4,576	22,968
Windbreak		
One-story	4,538	313
Two-story	13,346	5,936
Packed	15,132	24,844

In 1917, the average daily consumption of honey for the six hives, over a period of 139 days, was one eighth of a pound.

In 1918, the average daily consumption of honey for the six hives, over a period of 150 days, was one eighth of a pound.

Table II shows that in the winter of 1917–18, while the one-story hive in the open lost 332 bees during the winter, the two-story hive similarly placed gained 2,208 bees. With those bees protected by the windbreak the two-story hive gained 13,346, while the one-story hive gained only 4,538. During the winter of 1918–19 the one-story hive in the open lost 3,282 bees, while the two-story hive only lost 469. In the windbreak the two-story hive gained 5,936, while the one-story hive gained only 313.

If the number of bees at the beginning of the honey-flow be a proper standard, these results plainly indicate the superiority of the two-story hive. The same factors which make this possible ought to make the deeper and larger hives superior even to the two-story hive, since the latter will have plenty of room for stores and ample room for spring brood rearing without too large a space for the bees to keep warm.

COMPARATIVE VALUE OF A WINDBREAK

A study of Table I would indicate the value of a windbreak, especially to colonies which are not otherwise protected. In the case of the one-story hive, there were 2,345 more bees in the hive protected by a windbreak than in the unprotected one-story hive. The protected two-story hive had 4,530 more bees than the unprotected two-story hive. While the protected packed hive only had 1,776 more bees than the unprotected packed hive, thus indicating that although a windbreak is very valuable, yet if it is not possible to provide one the loss may be partially overcome by using sufficient packing. The figures shown in Table II also indicate very clearly the value of a windbreak. In 1917–18 the one-story hive lost 332 bees during the winter, while the one-story hive in the sheltered position gained 4,538. During the next winter, the same hives respectively lost 3,282 and gained 313. The two-story hive shows the value of a windbreak more clearly even

than the one-story, because while the two-story unsheltered hive gained 2,808 in 1917–18, the sheltered hive gained 13,346. In 1918–

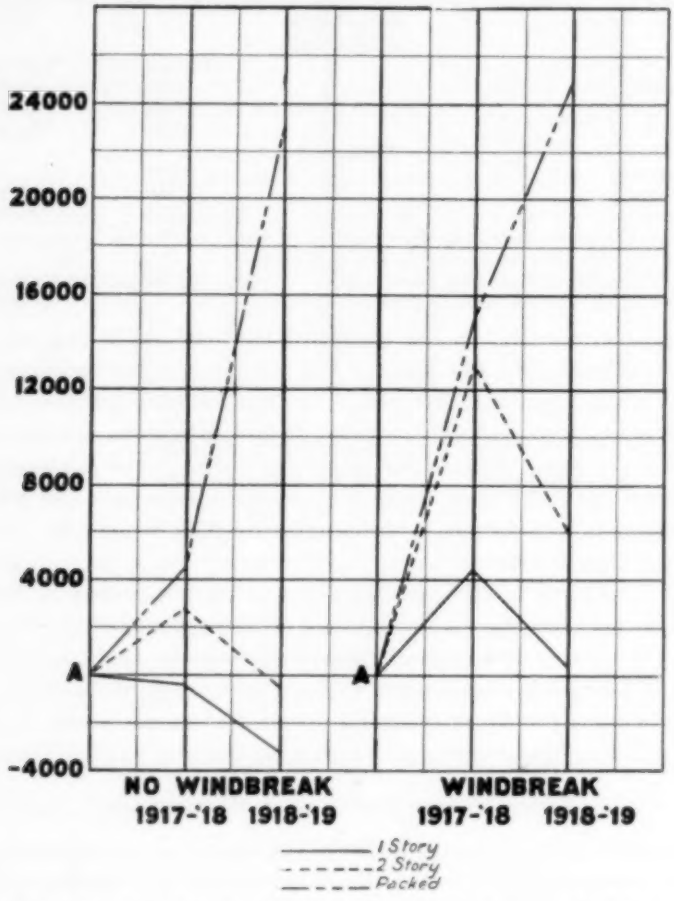


Fig. 2. Showing the gain or loss in the number of bees between the fall and spring weighings, demonstrating the value of both packing and windbreak.

19 the first hive lost 469 while the second gained 5,936. Judged by the standard already adopted, the windbreak is shown to be very valuable as a factor of winter protection.

Comparative Value of Packed and Unpacked Hives for Winter

During the winter of 1917–18, the packed hives were insulated with shavings and excelsior for packing material, but it was not as good as the forest-tree leaves which were used in 1918–19, and which will be used in the future.

Table I shows that the packed hive had 25,000 more bees than the one-story unpacked hive. This represents about five pounds of bees, which, at their present market value of around $2 a pound, would mean about $10. The difference between the number of bees in a packed hive and in an unpacked one in the sheltered set of hives was practically the same as in the open.

Table II, which gives the results for 1918–19, shows that the winter of 1918–19 was harder on the bees than was the preceding winter, and yet this is the winter in which packed bees wintered the best. In fact, there is more difference in this unfavorable winter between the packed and unpacked hives than in the more favorable one. This is shown by the fact that while the one-story hive in the open lost 3,282 bees, and the two-story hive 469, the packed hive gained 22,968. In the sheltered hives the one-story hive gained 313 bees, the two-story hive gained 593,

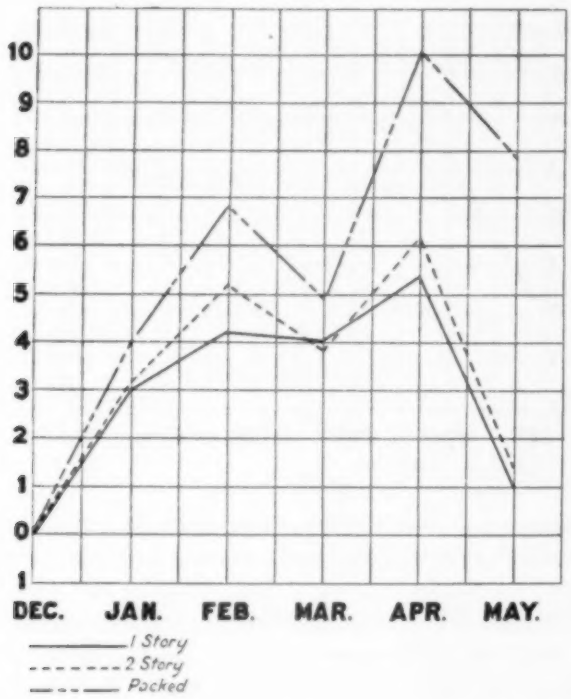


Fig. 3. A comparison of the amount of stores consumed each month by colonies in packed hives and the amount consumed by colonies in unpacked hives.

but the packed hive gained 24,844. When judged by the standard of the number of bees in the hive, packing appears to be the most valuable factor of wintering, excepting, of course, sufficient stores.

The Amount of Stores Necessary to Last a Colony Until the Beginning of the Honey-Flow

The amount of stores necessary to last a colony until the honey-flow begins will depend largely upon the size of the colony, size of the hive, and upon the amount of protection which it has.

Figure III represents, graphically, the amount of stores consumed by the bees in each kind of hive throughout the winter. As will be seen in an examination of this figure, the colonies in the one-story hive consumed less stores than any of the others, while the colonies in the packed hives consumed the most. This difference is especially noticeable during the month of March at which time the stores were being used for brood rearing. A comparison between Figure I and Figure III will show a direct relation between the amount of stores consumed and the number of bees present in each colony at the beginning of the honey-flow.

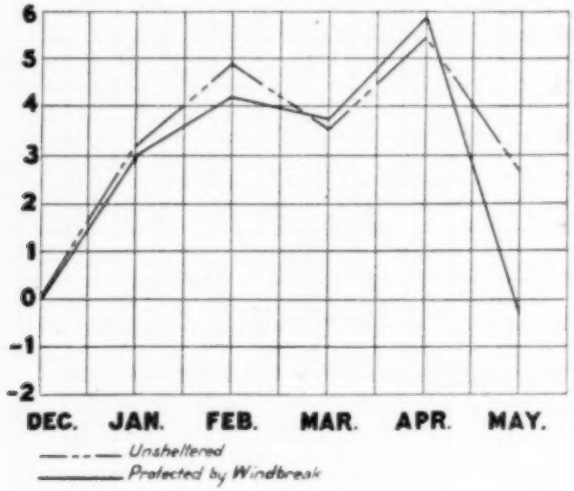


Fig. 4. A comparison of the number of pounds of stores consumed by colonies that are not sheltered with the amount consumed by colonies that are sheltered by a windbreak.

Figure IV represents a comparison of the amount of honey consumed by colonies wintered in the open, and those sheltered by a windbreak. The sheltered colonies consumed less during December, January, and February, but during March they used more than the unprotected colonies. During April they used less stores, or rather did not lose as much in weight, owing to the fact that brood rearing had continued for some time, and since it was greater in the sheltered colonies, the presence of the new bees, and what honey could be gathered at that time account for the fact that they gained weight during that month.

A study of this figure will show that during the months of December, January, and February, when stores were being consumed only to maintain the life of the bees that were already in the hive, those which were in sheltered positions did not consume as much honey as those in the open. However, during the month of March they consumed so much more honey than did the other colonies that the total amount consumed was about equal in both cases, the difference being that the colonies in the sheltered positions consumed their greater amount of stores for the purpose of brood rearing. Had weights been taken only at the beginning and end of these periods, the fact that the unsheltered hives consumed more at one time than the sheltered, and less at another, would not have been noticed.

TABLE III. MONTHLY CHANGE IN WEIGHTS

In the upper column for each month are placed those colonies protected by a windbreak and in the lower those not protected. Unless otherwise stated, the figures given represent a loss in pounds of weight.

One-story	*Two-story*	*Packed hive*
	December, 1918, to January, 1919	
2 6/8	3 2/8	3 4/8
3 2/8	3	4 2/8
	January, 1919, to February, 1919	
3 5/8	5 1/8	5 4/8
4 6/8	5 2/8	8 1/8
	February, 1919, to March, 1919	
4 1/8	3 4/8	5 4/8
3 7/8	3 3/8	4 3/8
	March, 1919, to April, 1919	
6 2/8	5 5/8	10 7/8
4 3/8	6 5/8	9 2/8
	April, 1919, to May, 1919	
4/8 gain	1/8 gain	4 1/8
2 5/8	2 5/8	11 5/8
	Total for 151 days	
16 2/8	17 3/8	24 4/8
18 7/8	20 7/8	37 5/8
	Average Daily Consumption	
1.6 oz.	1.8 oz.	2.6 oz.
2. oz.	2.2 oz.	3.9 oz.

Table III shows that the total amount of stores consumed for a period of 151 days was less for the one-story hive in the open, being 16 2/8 pounds, and greatest for the packed hive in the sheltered position. Reference to Figure I will show that the number of bees in the spring is proportional to the amount of stores consumed. The one-story unpacked hive lost 3,282 between fall and spring, while the packed hive gained 24,844. The difference between the sheltered and unsheltered colonies, as regards daily consumption, was 4/10 of an ounce for the one-story hives, 4/10 of an ounce for the two-story hives, and 1 3/10 ounces for the packed hives. It has been shown that less honey will be required to winter bees in a one-story hive than in either the two-story or packed hive; that less will be required in a two-story

hive than in the packed hive, and in each case less stores will be consumed where the bees are not protected by a windbreak than would be the case if they are protected, but the number of bees in the colony at the beginning of the honey-flow is directly proportionate to the amount of stores consumed by that colony during the winter.

The Effect of Climatic Conditions on Wintering

One of the arguments most commonly made against using winter protection is that the bees in some particular locality may not need any winter protection because that locality has such open winters.

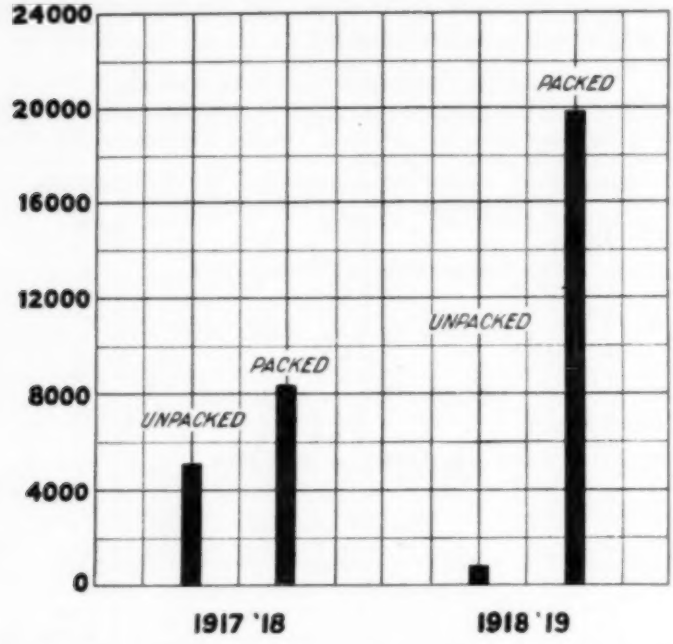


Fig. 5. Shows the average gain in number of bees in packed and unpacked hives during a severe winter with long periods of cold weather and the gain or loss in the same colonies during an open winter with shorter periods of cold weather.

Figure V represents, graphically, the effects of both a severe winter and an open winter upon the number of bees to be found in the colony in the spring. In the winter of 1917–18, which was very severe, bees were confined to their hives for long periods at a time, while the winter of 1918–19 was an open winter with no long periods of cold weather.

Figure V plainly shows which winter was the more favorable for the successful wintering of bees. During the severe winter of 1917–18, the one-story hive in the open lost 332, while during the open winter

of 1918–19 the same hive lost 3,282. During the severe winter, the two-story unprotected colony gained 2,808, while during the open winter this same colony lost 469. During the severe winter, the one-story colony, protected by a windbreak, gained 4,538, while in the open winter the same colony gained only 313. The two-story hive, protected by a windbreak, gained 13,346 bees during the severe winter, but only 5,936 during the open winter. However, the effect of climatic conditions is much more noticeable on the unpacked colonies than on the packed ones. The insulation which is placed around the hives protects the bees from any sudden changes of weather. If the warm sun beats upon unpacked colonies it soon causes a considerable rise in temperature within the hive. However, with a well insulated colony this would not be the case. Although the unpacked hives did not do as well during the open winter as they did during the severe winter, yet the packed hives did even better, owing to the fact, as explained before, that they were packed with leaves, which is a better insulating material than that which was used the previous winter. While one colony in the open was losing 3,282 bees, the packed hive in the open during this open winter gained 22,968, but in the windbreak, while the one-story unpacked hive gained 313, the packed hive gained 24,844.

The figure above, and the data which accompany it, plainly indicates that a severe winter, with long periods of cold weather, is really much more favorable than is the open winter with shorter periods of cold weather.

Form of Winter Protection Which Will Insure the Strongest Colony of Bees at the Beginning of the Honey-Flow

Reference to the figures given above would show that the two-story hive has advantages over the one-story hive, and also that probably for the same reason a large hive would be equally as good, if not better, than the two-story hive, and also that a well packed colony is greatly to be desired over an unpacked colony. The difference in the number of bees in the unpacked and packed hives is sufficiently great to more than repay the expense which a beekeeper may be put to in providing sufficient packing. In order to know the amount of stores to leave in the hive, the beekeeper must take into consideration the type of hive he is going to use. If it is a one-story to be used with no packing, he should leave at least 20 pounds of stores, as this would usually carry the bees through until the beginning of the honey-flow. However, 25 pounds would be a safer amount. If he is going to winter his bees in a two-story unprotected hive, then he had better leave 25 to 30 pounds, preferably 30 pounds. If, however, he is going to pack them he should leave enough stores to last well into the spring, as he will not need to

molest them during the early spring. For this reason he should leave 40 to 50 pounds. While ordinarily they would pass the winter well on 40 pounds, it would be better to have the 50 pounds in there for safety.

The value of a windbreak has been clearly shown, and as explained by Phillips and Demuth, this should consist of a broken windbreak, such as a hedge, or if a fence must be used, it should be so constructed that there will be large cracks between the boards. To sum up the whole thing: a packed hive sheltered from the wind by a good windbreak, having 45 or 50 pounds of stores, has the best chance of passing the winter successfully, and will probably contain the largest number of bees in the spring at the beginning of the honey-flow ready to take advantage of the same.

Summary

First. Directions have been given in previous publications as to the method for giving bees winter protection. The purpose of this work is to secure data showing the necessity of using this winter protection.

Second. Six hives containing a known amount of honey and a known number of bees were placed on scales, and daily readings taken of all changes in weight.

Third. Three of these hives were sheltered by a windbreak while the others were not.

Fourth. Each set of three consisted of one one-story hive, one two-story hive, and one packed hive.

Fifth. In addition to making daily readings of the changes in weights, a general weighing was made at the beginning of the honey-flow in the spring to determine the number of bees in the colonies on that date.

Sixth. These observations show that the two-story hive is preferable to the one-story hive, and the packed hive is much to be preferred over the unpacked hive.

Seventh. It was also shown that a windbreak is very essential, especially to colonies which have no other form of winter protection.

Eighth. The effect of a severe winter was found to be less injurious to the over-wintering of bees than an open winter.

Ninth. Colonies which are packed for the winter consume more stores, owing to the fact that more stores are necessary, due to increased brood rearing.

Literature Cited

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1915. Outdoor Wintering of Bees. Bul. No. 695, U. S. Dept. of Agri.

1918. The Preparation of Bees for Outdoor Wintering. Bul. No. 1012, U. S. Dept. of Agri.

GATES, B. N.

1914. The Temperature of the Bee Colony. Bul. No. 96, U. S. Dept. of Agri.

MR. G. M. BENTLEY: We have a great deal of trouble with the wintering of bees in Tennessee. We are sorry that Dr. Merrill is not with us to explain more concerning his methods. In Tennessee we have found it very difficult to interest people in the winter protection of bees, simply because we frequently have open winters. When Mr. C. E. Bartholomew was in Tennessee doing extension work in beekeeping, he patterned a winter hive, an enclosure, after that of Dr. Phillips, which included four hives with four entrances. That method of winter protection was pretty generally introduced, but the greatest trouble was that many beekeepers thought that nature had given them plenty of protection simply because the winters were not severe. With the experimental apiary at the Experiment Station we have found that sudden changes are the causes that have developed the dwindling or weak colonies of bees in the spring, often making them too weak to overcome that trouble. We have some concrete examples in the station apiary and in different parts of the state where persons who carefully pack their bees in the winter receive a yield of 110 and sometimes 200 pounds of comb honey per hive. The average production for the state of Tennessee is 39½ pounds, counting the log gum, the box hive, and the ordinary modern hive. Without any doubt winter packing in the southern states is a success.

MR. G. G. AINSLIE: Didn't I understand that the packed hive is a one-story or two-story hive?

MR. M. C. TANQUARY: A packed hive is only a single-story hive.

CHAIRMAN W. E. BRITTON: The next on the program is a three-reel motion picture illustrating beekeeping in the Californian National Forest. These reels have been furnished by Mr. George A. Coleman.

CHAIRMAN W. E. BRITTON: We will now listen to the report of the committee on nominations, consisting of Messrs. J. G. Sanders, E. C. Cotton and G. G. Ainslie.

MR. J. G. SANDERS: The Committee on Nominations presents the name of Mr. F. B. Paddock for Chairman and Mr. G. M. Bentley for Secretary for the ensuing year.

It was voted that the report of the committee be accepted and the recommendations adopted.

The above-mentioned members were declared elected and the session adjourned.

Morning Session, Thursday, January 1, 1920, 10.15 a. m.

PRESIDENT W. C. O'KANE: The chair desires to wish all of you a Very Happy New Year.

The first paper on the program is "The Work of the Railroad Entomologist," by V. I. Safro.

THE WORK OF THE RAILROAD ENTOMOLOGIST

By V. I. SAFRO, *Louisville, Ky.*

With the development of railroad agricultural departments, the need for railroad entomologists is coming more and more into evidence and it will be but a matter of a few years before every large railroad will have its entomological officials. There is a definite field in the agricultural and commercial activities of a large railroad which would come naturally under the jurisdiction of the entomologist—work which now is either entirely neglected or to a great extent imperfectly conducted. The intent of this article is to indicate to prospective railroad entomologists the lines of work that should come under their attention, and, incidentally, to crystallize for railroad agriculturists the duties that definitely necessitate the employment of entomologists.

The writer has based his discussion upon considerable work done for and with railroads, upon some five years of frequent contact with railroad entomologists, horticulturists, agriculturists, and their problems, and upon many excellent opportunities to observe the need of such work as is here indicated.

The occurrence and solution of certain entomological problems has been noticed from time to time in its most evident form; namely, the reduction of tonnage due to insect damage to crops. And whereas this is by no means the only line of endeavor for the railroad entomologist, it is the one line that the average railroad official can understand without the exhaustive explanation that may be necessary to justify the appointment of an entomologist for the solution of other entomological problems affecting railroad economics.

In instances that have come before the writer, the solution of any one of many of these common tonnage problems would of itself have paid the salary of the entomologist several times over and given a handsome profit to the railroad, and this is what the railroad official in authority will most easily understand.

POSSIBILITIES OF INCREASED TONNAGE

The writer has at hand a letter received some time ago from J. A. Hughes, horticulturist, American Refrigerator Transit Co., Missouri Pacific Railroad. He states:

"We are prepared to move about 3,000 cars of onions from southern Texas, and the Laredo district is suffering from one of the worst infestations of thrips I have ever seen. . . . We estimate the tonnage reduced fully 20 per cent on account of this pest."

It had previously been demonstrated in this same district that the ravages of the onion thrips could be materially checked by proper control methods; and, accepting Mr. Hughes's estimate of 20 per cent reduction in tonnage due to the onion thrips, the work of an entomologist for about two months in the Laredo district might have been conducive to a greater tonnage with a maximum possibility of increase amounting to 750 cars.

E. G. Kelly writes in the JOURNAL OF ECONOMIC ENTOMOLOGY, April, 1917, p. 233, that the "green bug" in 1916 destroyed 250,000 acres of oats and 100,000 acres of wheat in Kansas alone, mostly in only four counties. In Oklahoma, the destruction was estimated at 350,000 acres of oats and 160,000 acres of wheat. Mr. Kelly informed the writer at the time that a good part of this infestation could have been prevented by proper entomological procedure.

Proper entomological work at that time would not only have paid the railroad a profit amounting to many times the expenditure of the entomological service but would have increased the wealth of the population along the railroad and because of this would have materially contributed to the good will—an asset which the railroads recognize as being of exceeding importance.

The destruction of potatoes by the Colorado potato beetle is one of the very common examples. Within the last several years destruction of crops by the potato aphis has become evident, so much so that several railroads have endeavored to interest themselves to the extent of seeking relief for the growers of their respective districts.

The University of California, as a result of work on the peach worm at Newcastle, Cal., produced in one year an increase of 500 cars of peaches, as reported by the local railroad officials. After eight years of work at Watsonville, Cal., the tonnage of apples was increased to the amount of over 800 cars. Upon the completion of mosquito extermination work at Bakersville, Cal., land values increased 200 per cent.

The past season at Midland, Tex., arrangements were made to take care of the crop of honey dew melons. One hundred refrigerator cars, and sufficient ice accordingly, were reserved for the purpose. An epidemic of aphis occurred, found the growers unprepared and unequipped to meet it, with the result that the tonnage was reduced to only four cars. Here was a loss of tonnage, a loss of ice, ninety-six cars tied up when refrigerator cars were in demand elsewhere, a loss of revenue to the railroad and the refrigerator company of $150 per car.

The writer's definite results in increasing cantaloupe tonnage in southern California through control of severe aphis epidemics, leads him to state that practically all this tonnage could have been saved—an item amounting in transportation charges alone to about $14,400, to say nothing of loss to the growers in the section; and, in consequence, their lower purchasing powers and smaller shipments of purchases into the district.

These few random examples give a definite glimpse of possibilities.

Epidemics of grasshoppers, Colorado potato beetles, chinch bugs, etc., are too well known to merit further discussion here.

The cry of the roads is for tonnage, tonnage and more tonnage. Give them tonnage and they can use you whether you call yourself a freight solicitor or an entomologist.

Entomological Assistance and Crop Diversification

Crop diversification is an important item in railroad economics. The greater the diversification—within, of course, reasonable limits—the greater the economy effected in the distribution of rolling stock, labor and risks. A section devoted entirely to one crop may cause a railroad enormous loss by the failure of that crop. Diversification would tend to minimize the possibilities of total crop failures. Single crop districts give rise to freight congestions, shortages of cars, and embargoes—all of which problems can be minimized by proper diversification.

In many instances observed by the writer, the limiting factor preventing diversification has been an insect factor susceptible to satisfactory solution.

Several instances have come to the writer's attention in which some crops are grown only on a household scale which should be grown commercially in the same district. Such is often the case with cabbages, onions, melons and other truck crops. Entomological work in such instances may result in practically building up communities.

Often it occurs that crops, once established, are later abandoned because of insect pests.

Doctor E. D. Ball, in a letter to the writer dated April 16, 1917, stated that:

> "'Sugar beet blight,' caused by the puncture of the beet leaf-hopper, has been a very largely contributing cause of the abandonment of sugar beet raising in a number of western areas. Several factories have been dismantled and others are lying idle at the present time on this account, involving losses running into the millions of dollars in each case. These losses, while not entirely preventable in most cases, were sufficiently so to have maintained the industry if entomological assistance had been used."

He also states:

> "The sugar beet seed production was abandoned in the Arkansas Valley and other

districts of the Plains region on account of injury by the false chinch bug, an injury which might have been controlled by entomological assistance."

Doctor F. H. Chittenden, in a letter to the writer April 14, 1917, stated:

"The raising of seed beets has been practically abandoned in the east on account of the ravages in past times of the beet aphis."

The Imperial Valley, California, at one time had a distinct cabbage shipping season. Primarily because of the cabbage aphis and the lack of information among the growers on proper methods of control, the growing of cabbage on a large scale was at one time practically abandoned and even to the present time the production of Imperial Valley cabbages is much smaller than it would be under proper stimulation.

Coöperation Between Railroad and Grower and Other Agencies

The railroads recognize this item as being of considerable, often in fact of paramount, importance. Practically all railroads endeavor in some form, often very crudely and ineffectively, to foster such coöperation. Railroads have reprinted official bulletins or issued publications of their own, intended to disseminate the proper information not only to growers themselves but to business men, local banks, etc.

Railroad demonstration trains are of common occurrence and as this phase of agricultural activity becomes better known, the entomological work incident to such trains and railroad schools will become quite evident.

One example of this type of service will suffice: At one time the M. K. and T. Railroad sent out a notice to orchardists along its lines stating:

"Starting November 8 and running to December 3, we are coöperating with horticultural officials and authorities in this state, also with the U. S. D. A. in conducting an orchard clean-up campaign along our lines in Texas. . . . Our working force of practical scientific men will go into the field to prune, spray, dehorn and teach the care of orchards with all its relationship to the proper setting of fruit to all communities who desire this work."

Entomological Quarantine and Inspection

This problem is becoming increasingly prominent, and frequently arises to bother the railroad as well as the shipper. Most disagreements occur entirely as a result of lack of understanding of the true situation.

The railroad entomologist would have jurisdiction over inspection of cars for the gypsy and brown-tail moths, keeping cars used for ship-

ment of sugar cane free of scraps as a measure against the sugar cane moth borer, observance of pink bollworm precautions, interpretation and execution of entomological quarantine regulations generally, and the promulgation of such railroad regulations as will enable the road to properly observe the quarantine orders of the various states with least loss and friction.

The Entomologist a Builder of Good Will

Good will is recognized by business as a distinct and often a prime asset. It is a commodity that is capitalized, purchased, sold, leased. And here the entomologist can function as a most important factor. He can keep in touch with growers, individuals as well as organizations, and dealers to their ultimate benefit and protection. He can issue timely warnings of possible or threatened epidemics; he can assist growers to obtain proper material or outfits for their control work; he can warn against fraudulent materials or irresponsible concerns; he can press the passage of proper laws to protect the grower; he can urge enforcement of laws, otherwise permitted to lie dormant; he can function as coöperator with county agents, state and government officials; he can conduct demonstrations, schools and even correspondence courses; he can assist local health authorities along the line of elimination of flies, mosquitoes, etc., thereby being conducive to better living conditions, increased colonization, higher real estate values and greater prosperity and happiness generally.

President W. C. O'Kane: The paper is before you for discussion.

Mr. Leonard Haseman: I would like to know if any entomologist at present represents a railroad.

Mr. V. I. Safro: Before the war, I knew personally about eight or ten who devoted their entire time to such problems. There were in addition to these, two or three dozen who were primarily engaged in other work, but spent part of their time on entomological problems. The return of the railroads to their private owners will be an incentive to the railroad agriculturists to begin to organize their departments along solid definite lines.

Secretary A. F. Burgess: It seems to me that this paper is timely and has pointed out a field of activity that a good many of us have never considered. I can see where there might be some opportunities along this line that would be beneficial not only to the railroads and their shippers but to the entomologists as well.

Mr. C. L. Marlatt: One important point that the paper brought out which I want to emphasize with a word or two is the necessity for the inspection and clean-up of freight cars at the point of des-

tination. You recall, perhaps, the reports that have been published in our monthly Service and Regulatory Announcements of the findings in freight cars. You remember, perhaps, the items in relation to carriage of the potato beetle and also refuse Florida oranges and vegetables from Chicago to California. As a result of those findings, the Secretary of Agriculture addressed a letter to the railroad administration asking if measures could not be enforced to compel the cleaning of freight cars at the point of discharge of the contents, in order to prevent the carrying of pests. I think that is something that should be followed up.

PRESIDENT W. C. O'KANE: We will now listen to Mr. Pierce's paper on "Commercial and Professional Entomology—The Future of Our Profession."

COMMERCIAL AND PROFESSIONAL ENTOMOLOGY—THE FUTURE OF OUR PROFESSION

By W. DWIGHT PIERCE, *Consulting Entomologist, The Gage-Pierce Research Laboratories, Incorporated, Denver, Colo.*

We have for so many years looked upon entomology as either a pastime of men engaged in other occupations, or as a salaried federal, state or institutional profession, that we are apt to forget another very important branch of the science. In fact the rolls of our society have contained but few names of men who could not be classified under one of these heads. But this year it is different, and in coming years, the time is not far distant when the commercial and professional entomologists will outnumber their fellows.

For at least ten years there has been a strong undercurrent of discussion among the younger men in our science looking forward to the time when entomology would be unshackled and able to raise its head among the professional sciences. Many of us have realized the absolute impossibility of great progress in entomology until we could have at least as large a body of men unhampered by institutional or legislative restrictions, as there were under those conditions. We saw that when that happy day arrived the average pay in our profession would naturally be greater, because when a man has a chance to be a free agent he can bargain better for his salary. I recognize the fact that what I will say may open an entirely new line of thought to some of you and that some will not like to hear it. But I believe the majority will rejoice with me that the day is now at hand when entomology steps forth into new fields to make a new name for itself, as one of the great enconomic professions of the new world era.

I do not know positively how many men are already in the practical

field but when two of us stepped out of the harness on the same day with identical purposes there were many skeptics regarding the possibility of our making a living. They are probably still skeptical and to such as assume such an attitude there is no future outside of the subsidied ranks.

If in the beginning entomologists had started out as professional and consulting specialists, matters would have been quite different. It happened, however, that the public had first to receive a long course in instruction as to what we as a profession could accomplish. Governmental and state institutions were about the only means available for proving our worth. The world knows what we can do now. They are willing to pay us for our expert advice, provided, of course, we make a reputation for giving correct advice. As a matter of fact there are many people on this earth who would rather pay for advice than receive it free, and many would rather have some one do a technical piece of work for them for a higher price and feel that it was done right than do it themselves. That is the reason I say that the day is come when a well trained man can hang up his shingle as a consulting entomologist and make a successful business of it.

I would not advise a man to start out this way without a little capital, for no professional man gets into full swing in the first year of his practise. As a matter of fact some of us decided several years ago that it would be necessary to have two years living expenses laid up in reserve.

What better combination could we have for the man just starting out, than a little rented plot of ground with a truck garden on which he can experiment, and some hives of bees? His shingle hanging over the door, and a neat business card and letter head, with a simple announcement in the local papers would open the ball. He would build up as large a private library as he could from free publications and then buy more important volumes as he was able. He must be a good mixer and go out among the farmers and business men who may have need of him and show that he knows what he is talking about. He must have sufficient imagination to see new fields of effort and then try to get into them. He should endeavor to secure the agency of a good series of insecticides and machinery for applying them. It would pay him to give free demonstrations occasionally. He will soon have assistants on the job.

I have mentioned bee culture. I wonder how many of us realize what a paying business it is when properly conducted. There are great futures in honey production and you can easily get your start while holding on to the position you now occupy. If you let the apiary grow normally you will soon find you must part either with position

or with the bees. To be a producer in this world is a great thing. Think hard before you choose to stay with that salary.

The commercial field is linked absolutely with the professional. There will be some men who will elect only to do advisory work, and remain aloof from the practical application. There will be some who will undertake sanitary projects only, and some who will elect to go forth with spraying outfits or gas generators, but I believe that most of us will combine the consulting, the practical application, and the purely commercial.

What is the field of commercial entomology? It is the largest field for development in our science, although few have yet learned it. Modern business is being cast into new lines. Pick up any current magazine and glance at the advertisements of all industry and see how the emphasis is put upon scientific management, scientific processes, etc. Open your eyes to what is going on in the business world and you will see that the great manufacturers of America know that to survive in the new order of things they must have the best technical advice available in the world today. Do you know any place where your technical knowledge would benefit some great business? If you know and do not act it is because you are not alive to your own potentiality. Modern business will give you every opportunity to prove your ability and will pay you what you are worth. Furthermore the modern business man is alive to the value of having his men attend meetings and conventions; to well worded advertisements written by men who know what they are talking about; and to scientific publications from the pens of his employees. There is nothing admired more in business than brains, and foresight and initiative. If you can show a business man where you can make him money or save money for him you can name your price.

As a salaried technical man in the industries you are in reality an independent, because rival corporations are watching your results and will bid for you if they see you can better their business. Furthermore in the business world you rise or fall on your own merit and not because of secret machinations of officialdom. You may make enemies but business enmity is more open. You are constantly at the seat of commercial warfare and you know that you must give results. You will be free from the laissez-faire policy which has so retarded the progress of official entomology.

I will now speak of the field in which I am most interested. It is a combination of investigation, consultation, demonstration, practise and manufacture. Why should we not carry our work beyond the mere investigation and when we find a new insecticide, manufacture it, or arrange to have it manufactured? Hence the desirability of

uniting forces with men of other professions who can coöperate with us. Thus the metallurgist, chemist, entomologist, and agriculturist make a fine combination. One needs a particular insect controlled, another finds out how to control it, the third finds how to make the substance, and the fourth extracts it from the raw materials.

In the future we are going to have new series of insecticides. We are going to have insecticides which will conform more nearly to standards. We are going to find out more accurately how insecticides kill, because it will be our business to make the most efficient killing substances we can get. We will not put out substances that will kill the insect and also injure the plant or animal we want to protect, because we must continue to sell and the public will not buy unless we give results.

Are we not naturally going to get greater progress in insect control when entomologists are in the ring trying to learn the very basic principles of control so that they will have the best product on the market? Can you not see the great stimulation which modern business is giving to research? The commercial research man is given definite practical problems to solve. He knows that when he solves them, they will be put into practise and commuted into the coin of the realm. He also knows that there will be a suitable reward for his industry.

Men are going to be in demand. But they must be men who are wide awake to the field. They must be men who are thinking about these things and studying to equip themselves for this great field of future investigations. More men must be trained. And the training of entomologists for practical life is quite different from the training for pure science. Our professors must begin to think out new courses of training, with practise as the dominant note.

New insecticides acting along new principles will from time to time appear on the market and our colleagues in official positions will find they must give these fair tests. There must be open mindedness on both sides. We must have coöperation and fellowship in our science. If the official investigators need a particular substance put on the market in sufficient quantity and of proper quality at prices which will bring results, they will get results quickest through active coöperation with their professional brothers who are in a position to do this. The official worker has a problem to solve and wants to try many new substances but finds them difficult to obtain. If he calls in his professional colleague and asks his coöperation, between them they will get results.

We can not insist too often on the necessity of forever relegating to the past the days of the selfish investigator who tries to do all his work alone so that no one else can participate in the credit. We have ar-

rived at an age of coöperation in groups, so that we may progress faster in the solution of the great problems lying before us. Two or three or more men working together and frequently conferring on the progress of their work can do twice as much work as those same men working separately, each jealous of the other's progress.

During the past year quite a number of us have entered this new profession and in the future many more of you will follow suit. My next words are addressed to you future consulting entomologists. First of all we must be actively associated together so that we can pull for each other, and when calls for assistance come which would more normally be in another man's territory we can exchange services. By starting right we can be mutually helpful and build up a corps of experts in this country that the nation will respect. If we start wrong with the idea of grabbing every job for ourselves and letting our fellows starve; if we undercut the other fellow; cast slurs upon his reputation and in every way conceive enmity toward him because he is a rival specialist, we get nowhere. How closely we can associate ourselves depends upon our good will toward each other and the prospects before us. It may be merely to exchange views, it may be to exchange prospective clients, it may be to link ourselves into a closely knit financial coöperation.

Every man trained in entomology will not necessarily be a good man to enter this new field. He must be able to accommodate himself to his clients' way of thinking and find a way to help that will be understood. He must know how to advertise his brains and his wares convincingly, and must refrain from going over the heads of clients. But above all he must either know how to solve his problems or who can solve them for him.

In other words our professional man has to be an all round entomologist or have enough assistants or associates to cover the whole ground. If he does not know offhand the answer he must know how to get the answer.

This brings us back to the school training. You can not go into the commercial field and be in ignorance of ordinary business law. You must know how to give financial accounting to the government and to your associates. You must know how to figure costs and profits. Thus an orchard owner comes and asks you to bid on the spraying of his orchard. You look it over, and when you are through you must make him a bid which will correctly cover the costs of labor and supplies and yield you a modest fee. There will be competitors, so you must be able to get your supplies at the best figure and must do a job that will give satisfaction. In other words the future curriculum will embrace commercial arithmetic. I would advise a course in

mapping, charting, plotting, and interpretation of statistics and data, because very few people really grasp the meaning of a mass of figures. It is a subject worthy of intensive study. The proper presentation of your data is essential to the success of your work.

As to entomological training, unquestionably the pupil must be given the theories of insect behavior, classification, and control, but more important than that, he must be taught how to recognize the insects in the field, how to recognize their work. He must be an outdoor man with a keen eye, and should take copious notes. The man who can properly place insect damage and because of his knowledge of insect habits can immediately advise at least temporary expedients is worth more than the indoor theorist who can tell you what to do when he gets a proper determination. We are rapidly learning how to identify the insect from its immature stages. The teacher can not too strongly emphasize all that he can gather together on this subject. Of course the theory of control must be taught but I would combine it with actual experience with the apparatus in the field. Have the student actually undertake the control. He won't forget what he has done. He may easily forget what you tell him.

So let us all work together to build up the future of our science.

We stand today at the threshhold of a new era. Will entomology knock at the door of opportunity and ask admittance to the council rooms of the elect or will we slink along and greedily take the crumbs that are condescendingly thrown our way? Too long has it been the custom in entomological circles to push aside ambitious programs for improvement and enlargement of our work with the remarks that such programs are not according to precedent, or that we would be turned down if we made such a proposal, and so opportunity after opportunity has died because of that obsessing fear that defeat would result.

Defeat will most assuredly come to him who makes a suggestion expecting at the time it would be turned down.

The war has caused the world and especially the American people to look quite differently at the problems which face us. We see now that things must be done on a far more comprehensive scheme, that community and state or national coöperative action is necessary to accomplish the tasks of the new era. We entomologists, trained in a school of conservatism, must adjust our viewpoint to the new situation.

Service is the standard by which all professions will be rated in the coming days. No longer may we sit with satisfaction at our desks and calmly study our insect problems with no care as to the general public. The nation is watching us. They know that we hold the keys to the problems of agricultural loss and the loss of health, or that we should hold them if we don't. Now the public wants service, and

service that can be recognized as such. Are we ready to give it? Are we willing to adjust our ways and manner of thought so that we can in the future give this service demanded of us?

PRESIDENT W. C. O'KANE: Is there any discussion on this paper? If not, we will go to the next paper, "Notes on Poisoning the Boll Weevil," by Wilmon Newell.

NOTES ON POISONING THE BOLL WEEVIL

RESULTS OF AN INVESTIGATION TO DETERMINE WHETHER THE PRESENCE OF DEW OR RAIN WATER ON COTTON PLANTS IS NECESSARY TO THE EFFECTIVE USE OF ARSENATES

By WILMON NEWELL and ELI K. BYNUM

While it is not our object in the present paper to review the history of the various attempts made to poison the boll weevil it is, nevertheless, pertinent to call attention to the fact that since the publication by the senior author and Mr. Geo. D. Smith, in 1909,[1] of experimental results which showed conclusively that the boll weevil could be profitably poisoned with powdered lead arsenate, close attention has been given this problem by the Bureau of Entomology. Since 1909 experiments with lead arsenate, and later with calcium arsenate, have been made at the Tallulah (Louisiana) laboratory of the Bureau, by Mr. Geo. D. Smith and subsequently by Mr. B. R. Coad, under the direction of Dr. W. D. Hunter.

After eight years of investigation the Bureau of Entomology, in July, 1918, finally committed itself to the proposition that the boll weevil can be poisoned with profit and has recently undertaken to promote the general use of arsenates, particularly calcium arsenate, for practical control of the boll weevil by cotton planters.

According to Bulletin No. 731, United States Department of Agriculture, by Mr. Coad, issued July 19, 1918, successful poisoning of the boll weevil is based upon the supposed habit of the boll weevil in drinking dew or rain water which collects on the cotton plants, this water presumably becoming poisoned by the application of calcium arsenate in the form of a dust or cloud.

Experiments made by Mr. T. C. Barber and the senior author of the present paper, in 1906, 1907, and 1908, seemed to show quite conclusively that mortality among the weevils, following application of an arsenical poison, was due to ingestion of the poison with their food, particularly when the poison was applied in such a way as to penetrate between the tender leaves in the terminal buds of the cotton plant or

[1] Circ. 33, Louisiana Crop Pest Commission, Dec. 1, 1909.

to cover the cotton square (bud) itself.[1] It was upon these results that the field work of 1909, by Mr. Geo. D. Smith and the senior author, was based and which showed an increased yield of cotton averaging 71 per cent in the poisoned plats of thirteen field experiments.

The question of whether the boll weevil is killed through ingestion of poison with its food or through drinking dew or rain water containing the poison is an important one, as bearing upon practical work in controlling the insect. If mortality is due to ingestion of the poison while the weevil is feeding manifestly that method of application will be most successful which places the poison directly upon those portions of the plant where the weevil is most likely to feed. On the other hand, if mortality is due to the weevil being poisoned by imbibing dew or rain water on the treated plants, any method of wholesale distribution of the poison throughout the cotton field will accomplish the desired purpose. The machinery used in these two methods of application will vary greatly and a correct understanding of the manner in which the weevil is poisoned by the use of lead or calcium arsenate will, therefore, prevent needless expenditure by the cotton planter in machinery which is not adapted to the purpose and also tend to increase the efficiency of the poisoning operations.

For the purpose of determining the point mentioned very careful experiments were conducted at Madison, Fla., during the summer of 1919, the work being immediately in charge of the junior author, assisted by Messrs. A. C. Brown, K. E. Bragdon, J. C. Goodwin and Walter F. Eberhardt, of the Florida State Plant Board. The work was inspected at frequent intervals by the senior author. Office and laboratory facilities at Madison were generously made available for us by Dr. W. D. Hunter of the Bureau of Entomology.

The powdered arsenate of lead used in these experiments was represented by the manufacturer to contain "not less than 30 per cent" of arsenic oxide and "less than 1 per cent" of water soluble arsenic.

The powdered calcium arsenate used was represented to contain "total arsenic oxide 40 per cent" and water soluble arsenic "$\frac{3}{4}$ per cent" and met the specifications laid down by Mr. B. R. Coad for calcium arsenate suitable for boll weevil poisoning.

Experiments were made under field conditions and also in the laboratory. The former will be first discussed.

Field Cage Experiments

The field experiments were conducted in cages 3 x 3 feet, $4\frac{1}{2}$ feet in height, of 16-mesh galvanized wire-cloth, made as nearly insect-tight as possible. Cotton plants in the field were treated with calcium

[1] Circ. No. 23, Louisiana Crop Pest Commission, July, 1908.

arsenate and others with lead arsenate, using approximately ten pounds of the poison per acre. Cages were then placed over individual treated plants (see fig. 1), each cage floored with paper as tightly as possible and fly paper placed around the outside lower edges of the cage to exclude ants and a counted number of field-collected boll weevils introduced into each cage. Certain cages were covered at night and during showers with a heavy oilcloth cover, extending to within 12 inches of the ground (see fig. 2) so that the plants were protected against all deposition of visible moisture. Other cages, paired with these in the experiments, were not supplied with covers and the plants in them received the same precipitation of dew and rain as plants under normal field conditions, except that covers were placed on them when severe storms occurred in order to prevent excessive washing off of the poison or possible drowning of the weevils.

Corresponding cages, both "covered" and "uncovered," were placed over non-poisoned plants to serve as checks. Observations were made twice daily in all cages to determine the mortality among the weevils. The following table, showing the results obtained in two series of experiments, using lead arsenate and calcium arsenate on both covered and uncovered plants, is typical of the observations made on the total of 2,250 weevils used in the field experiments.

TABLE I. MORTALITY AMONG BOLL WEEVILS ON PLANTS PROTECTED FROM DEW AND RAIN ("COVERED") AND ON PLANTS EXPOSED TO DEW AND RAIN ("EXPOSED"). FIFTY WEEVILS PER PLANT, ONE PLANT PER CAGE. SIX CAGES. POISON APPLIED 7 P. M., SEPTEMBER 16, BY DIRECT APPLICATION WITH DUST SPRAYER ("BLAST METHOD") AT ABOUT 10 POUNDS PER ACRE.

Date	Number weevils dead each day					
	Treated with lead arsenate		Treated with calcium arsenate		Check ("natural mortality")	
Sept.	Covered* (Ser. 1) (50 weevils)	Exposed† (Ser. 11) (50 weevils)	Covered* (Ser. 1) (50 weevils)	Exposed† (Ser. 11) (50 weevils)	Covered* (Ser. 1) (50 weevils)	Exposed† (Ser. 11) (50 weevils)
17	3	2	3	0	0	0
18	4	5	4	6	0	0
19	13	11	17	9	1	0
20	11	11	8	6	0	0
21	4	3	2	2	0	0
22	6	3	4	3	0	0
23	4	4	4	3	1	0
24	2	2	0	3	0	0
25	1	2	2	0	1	4
Totals	48	43	44	32	3	4
Weevils alive at end of exp.	2	2	1	4	28	38
Missing	0	5	5	14	19	8

* No visible moisture on plants at any time during experiment.
† Heavy dew on plants on Sept. 17, 24 and 25; medium dew on 19th, 20th, 21st, 22nd and 23rd and light dew on 18th.

In all, nine series of experiments, such as described above, were made. Each "series" consisted of one cage-covered cotton plant treated with lead arsenate, one with calcium arsenate and one check cage, the latter containing the same number of weevils used in each of the other cages, in order to determine the "natural" mortality.

Observations were made twice daily on 750 weevils confined on plants treated with lead arsenate, 750 on plants treated with calcium arsenate and 750 confined on non-treated cotton plants but which were otherwise under the same conditions as those on the treated plants.

The following table shows the daily mortality, in percentages, among the weevils on plants treated with lead arsenate when protected from dew and rain, namely, kept entirely dry during the course of the experiments, and on plants similarly treated which were exposed to normal deposition of dew and light rains, being protected only from severe storms.

The deposition of dew on the exposed plants was of almost daily occurrence, heavy dew occurring on 20 mornings, medium dew on 17 mornings, light dew on 9 mornings and no dew on 10 mornings during the 60 "experiment-days" that these investigations were under way. Light rain fell on one morning. During the course of the experiments only one storm occurred which required the covering of the cages which were under "normal" conditions as to precipitation of dew and rain.

Of the nine plants treated with lead arsenate, three received the poison by the direct application or "blast" method and six by the "cloud" method as advocated by Coad. Of the three receiving treatment by the former method one was protected from all dew and rain and two were exposed to normal precipitation. Of the six treated by the cloud method two were protected from dew and rain and four exposed to normal precipitation.[1]

Poison used	Method of application	Number of weevils	Mortality during 10 days, per cent
Lead arsenate	Blast	150	88.6
Lead arsenate	Cloud	600	74.7
Calcium arsenate	Blast	150	79.3
Calcium arsenate	Cloud	600	74.2
Check	None	750	16.1

[1] Although the primary object of these investigations was to determine *how* the weevil obtains sufficient poison to produce death, the experiments were, nevertheless, so arranged as to give data on other questions. The data have been tabulated, for example, to show the mortality resulting from application of lead arsenate by the blast or direct method and by the cloud or settling method; also to show the comparative mortality when calcium arsenate was applied by both these methods. This information is summarized in the following table which shows the mortality among the boll weevils during the first 10 days following the applications:

Type of cages used over treated cotton plants in the field to determine mortality among boll weevils under varying conditions. (Original.)

Type of oilcloth covers used to prevent deposition of dew on certain of the treated plants.

TABLE II. PER CENT MORTALITY AMONG BOLL WEEVILS ON LEAD-ARSENATE TREATED PLANTS: (A) PROTECTED FROM DEW AND RAIN, AND (B) EXPOSED TO DEW AND LIGHT RAINS, DURING FIRST 10 DAYS AFTER TREATMENT

24-hour period after application	A		B	
	Protected from dew and rain		Exposed to dew and light rains	
	Treated (250 weevils in 3 cages) per cent	Check (250 weevils in 3 cages) per cent	Treated (500 weevils in 6 cages) per cent	Check (500 weevils in 6 cages) per cent
1st	7.2	0	9.0	1.4
2nd	8.8	0	11.4	1.4
3rd	18.4	2.8	12.	1.2
4th	15.2	0	10.	1.4
5th	9.6	0.4	7.	1.4
6th	9.2	2.4	6.8	2.0
7th	7.6	.4	5.	0.4
8th	3.6	2.8	5.6	1.8
9th	2.4	2.4	3.2	3.2
10th	3.6	2.8	3.8	3.0
Total mortality	85.6	14.0	73.8	17.2

Comparison of the data in the above table is easily made by means of the following chart, in which the daily percentage of mortality is shown in the case of both the covered plants and those exposed to normal deposition of dew and rain.

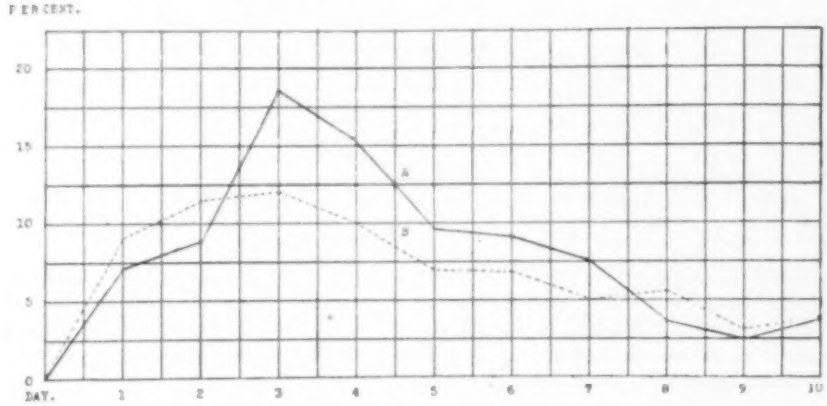

Chart 1.—Daily mortality, in percentages, among weevils on cotton plants treated with lead arsenate: heavy line (A), among 250 weevils on plants protected from all dew and rain; broken line (B), among 500 weevils on plants exposed to normal deposition of dew and rain.

The same information is also contained in the following chart, in which "A" shows the total mortality, during the first ten days after

application, on plants entirely protected from dew and rain and "B" the total mortality on plants exposed to light rains and normal deposition of dew. A_1 and B_1 show, respectively, the total natural mortality among weevils confined under identical conditions but on non-treated plants.

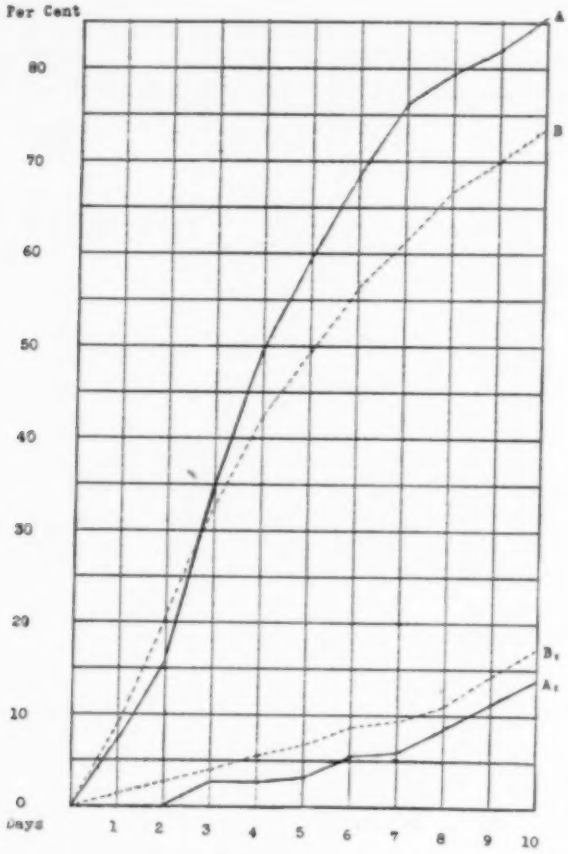

Chart 2.—Diagram showing total percentage of mortality among boll weevils on cotton plants treated with lead arsenate: A, on plants protected from all dew and rain; B, on plants exposed to normal precipitation. Also natural mortality among weevils on non-treated plants: A_1, on plants protected from all dew and rain; B_1, on plants exposed to normal precipitation.

Identical experiments were made using calcium arsenate, instead of lead arsenate, as the poison and using the same check cages. The following table shows the results obtained when using calcium arsenate, instead of lead arsenate, the arrangement of cages, method of applications, etc., being the same.

TABLE III. PER CENT MORTALITY AMONG BOLL WEEVILS ON CALCIUM-ARSENATE TREATED PLANTS: (A) PROTECTED FROM DEW AND RAIN, AND (B) EXPOSED TO DEW AND LIGHT RAINS, DURING FIRST 10 DAYS AFTER TREATMENT

24-hour period after application	A		B	
	Protected from dew and rain		Exposed to dew and light rains	
	Treated (250 weevils in 3 cages) per cent	Check (250 weevils in 3 cages) per cent	Treated (500 weevils in 6 cages) per cent	Check (500 weevils in 6 cages) per cent
1st	8.8	0	13.6	1.4
2nd	14.0	0	15.4	1.4
3rd	19.2	2.8	11.6	1.2
4th	10.8	0	8.6	1.4
5th	4.8	0.4	5.8	1.4
6th	6.0	2.4	4.0	2.0
7th	6.4	0.4	4.6	.4
8th	3.2	2.8	4.8	1.8
9th	3.2	2.4	3.0	3.2
10th	2.4	2.8	2.4	3.0
Totals	78.8	14.0	73.8	17.2

The following chart shows the above information in graphic form, *i. e.*, the daily mortality on treated plants protected from dew and rain and on treated plants exposed to normal precipitation.

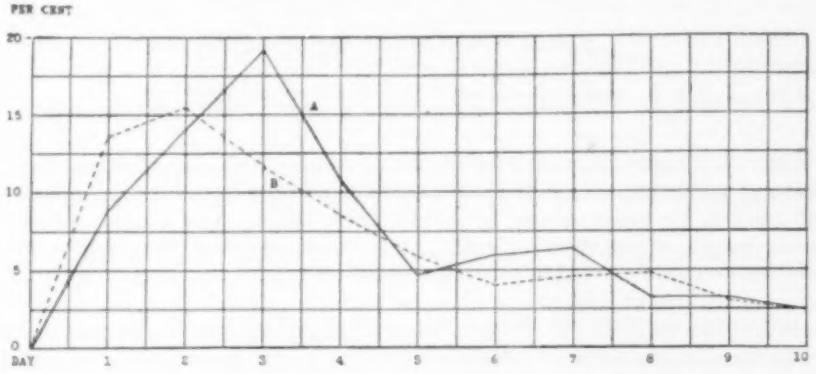

Chart 3.—Daily mortality, in percentages, among weevils on cotton plants treated with calcium arsenate: heavy line (A), among 250 weevils on plants protected from dew and rain; broken line (B), among 500 weevils on plants exposed to normal deposition of dew and rain.

Chart 4 shows in graphic form the total percentage of mortality as given in Table III and Chart 3.

The increased mortality among the weevils on treated plants protected from dew and rain, as compared to the mortality on treated plants exposed to deposition of dew and rain is very marked.

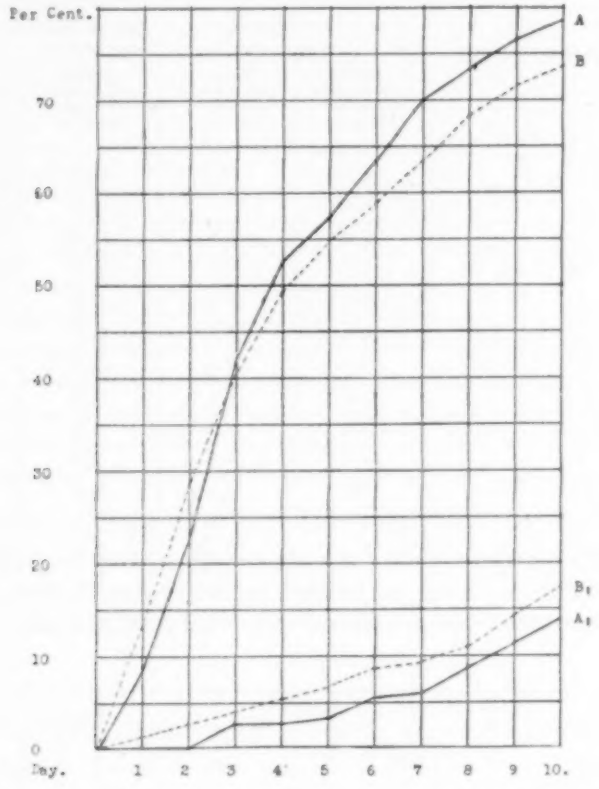

Chart 4.—Diagram showing total percentage of mortality among boll weevils on cotton plants treated with calcium arsenate: A, on plants protected from all dew and rain; B, on plants exposed to normal precipitation. Also natural mortality among weevils on non-treated plants: A_1, on plants protected from all dew and rain; B_1, on plants exposed to normal precipitation.

Reference to Table II shows that, using lead arsenate, the mortality on protected plants was 85.6 per cent during 10 days and on exposed plants was 73.8 per cent. During the same period the natural mortality, as shown by the weevils on non-treated plants, was 14 per cent on plants protected from dew and 17.2 per cent on plants exposed to dew. The mortality creditable to the lead arsenate was therefore 71.6 per cent in the case of the weevils on plants kept dry and 56.6 per cent on plants exposed to dew, or a mortality greater by 15 per cent on plants kept dry than that on plants receiving dew.

When calcium arsenate was used (Table III) the mortality on protected plants was 78.8 per cent and on "exposed" plants 73.8 per cent, the checks being as given above, giving a mortality, due to the poison of 64.8 per cent on dry plants and 56.6 per cent on plants exposed to dew, a gain of 8.2 per cent when the plants remained dry.[1]

The foregoing results seem to show conclusively that, as the mortality on dry plants was perceptibly higher than on those exposed to the deposition of rain and dew, the presence of visible moisture is in no way necessary to the effectiveness of either lead or calcium arsenate. This forces us to the conclusion that the weevil is killed by ingestion of the poison in feeding and not when drinking dew or rain water as claimed by Mr. Coad.

The investigation was, however, pursued along other lines, largely under laboratory conditions.

The Toxicity of Dew from Poisoned Plants

Investigations were also made to determine the amount of arsenic contained in dew which was deposited on cotton plants which had been treated with both lead arsenate and calcium arsenate. Upland cotton plants in the field were treated by dusting them with lead arsenate in the usual manner, at the rate of about 8 pounds per acre. Other plats were treated in like manner with calcium arsenate. The dew was collected from these plants, early in the morning, by the use of shell or specimen vials. It was found that by carefully touching the lip of the vial to the dew drops suspended from the edges and tips of leaves that the dew could be, though rather tediously, drawn off into the vial and a sufficient quantity thus accumulated for laboratory experiments. Dew was collected only from leaves well covered with poison.

Dew collected in this manner was submitted to Mr. S. E. Collison, chemist of the University of Florida Experiment Station, for quantita-

[1] The data secured in these experiments affords an interesting comparison between the effectiveness of lead arsenate and of calcium arsenate.

On plants protected from moisture the mortality ascribable to lead arsenate (Table II) was 71.6 per cent and to calcium arsenate (Table III) 64.8 per cent, a difference in favor of the lead arsenate of 6.8 per cent, but the mortality ascribable to lead arsenate on "exposed" plants (Table II) was 56.6 per cent and to calcium arsenate (Table III) also 56.6 per cent.

In the case of application by the blast method, all experiments, lead arsenate gave a mortality of 88.6 per cent during ten days and calcium arsenate a mortality of 79.3 per cent, a margin of 9.3 per cent in favor of lead arsenate. Applications by the cloud method, all experiments, gave a mortality with lead arsenate of 74.7 per cent and with calcium arsenate a mortality of 74.2 per cent. The mortality in the check was 16.1 per cent (see footnote, p. 9).

tive analysis. The following table shows the number of parts of arsenic per million in the dew as determined by Mr. Collison. Each sample of dew analyzed was collected from leaves well covered with poison from several dozen plants in different parts of the treated plat and the arsenic content may, therefore, be considered as decidedly above the average arsenic content of dew on treated plants.

From plants treated with	Dew collected	Parts arsenic per million
Lead arsenate	First morning after application	6.7
Lead arsenate	Second morning after application	6.7
Calcium arsenate	First morning after application	43.5
Calcium arsenate	Second morning after application	10.00

From the foregoing it is seen that the actual amount of arsenic in the dew from treated plants is remarkably small, even when collected from leaves heavily coated with the arsenate, and presumably a weevil would have to consume very considerable amounts of it in order for it to prove fatal. Experiments were accordingly made to determine whether such dew would prove fatal to boll weevils when all other sources of moisture were eliminated.

Large battery jars were prepared, each jar having a layer of dry sand in the bottom and the top covered with cheesecloth to permit circulation of air. A counted number of field-collected weevils was introduced into each jar and thereafter supplied with dew, collected from the treated plants the morning following the application of poison, by placing the dew in shallow tin trays. No other water was supplied and the weevils had no food. Corresponding lots of field-collected weevils were kept in similar jars, but supplied with clear water instead of dew and the daily mortality noted. Under these conditions the weevils went rather frequently to the dew in the trays and remained with their beaks inserted in the dew for periods varying from $1\frac{1}{2}$ to 5 minutes, $2\frac{1}{4}$ minutes being about the average. It is assumed that they were drinking during these periods.

The mortality, during 10 days, among 80 weevils supplied only with dew from lead-arsenate treated plants was 80 per cent, among 80 with dew from calcium-arsenate treated plants was 68.7 per cent and among 80 with clear water was 43.7 per cent; all of which is shown in the following chart:

In the course of these experiments one weevil lived for 12 days on an exclusive diet of dew from calcium-arsenate treated plants and

two lived for 13 days and one for 19 days on dew from lead-arsenate treated plants.

From the foregoing chart it is seen that the mortality was not appreciable until the weevils had been drinking the poisoned dew for more

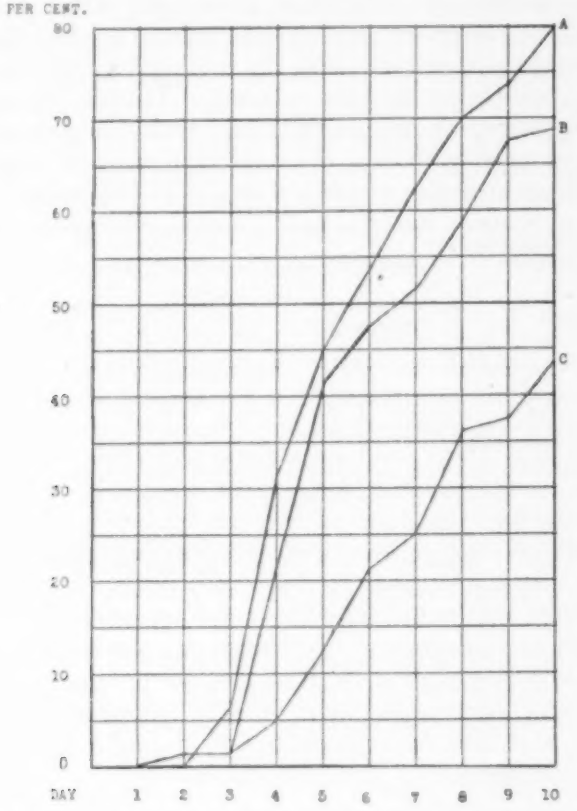

Chart 5.—Total percentage of mortality among weevils deprived of all food and furnished only with: A, dew from plants treated with lead arsenate; B, dew from plants treated with calcium arsenate; C, clear water.

than three days. Therefore, under normal field conditions the mortality caused by drinking dew containing poison is so small that no practical degree of control through this cause can be expected. Besides, a careful study of the weevil's habits indicates no tendency to drink dew in such quantities as would be necessary for successful poisoning if the weevil secures the poison mainly or entirely in this way.

The following experiments approximated field conditions in that weevils were furnished with both dew from treated plants and with fresh cotton squares as food.

Mortality Among Weevils Supplied with Food and with Dew from Treated Plants

Field-collected weevils were confined in battery jars as described in the preceding experiments, furnished with dew from treated plants in the same manner and in addition given fresh cotton squares each morning. They, therefore, had cotton squares as a source of both food and moisture, as is the case in the field, and in addition had dew constantly available for drinking purposes. The mortality, during 10 days, among 80 weevils confined with dew from lead-arsenate treated plants, 80 confined with dew from calcium-arsenate treated plants and 80 confined with clear water is shown in the following table.

Table IV. Daily Mortality Among Boll Weevils Supplied with Food and with Dew from Poisoned Cotton Plants

Liquid	Number weevils confined	Daily mortality										Total dead during 10 days	Per cent mortality during 10 days
		1	2	3	4	5	6	7	8	9	10		
Dew from lead-arsenate treated plants	80	0	0	0	0	0	1	2	0	2	1	6	7.5
Dew from calcium-arsenate treated plants	80	1	0	0	0	0	1	0	1	1	1	5	6.2
Water ("check")	80	0	0	0	0	1	0	1	1	5	0	8	10.0

As the mortality among the weevils having access to water was fully as great as that among those having access to the poisoned dew it is at once evident that either the weevils did not partake of the dew or they did not drink enough of it to cause any mortality. It is to be remembered, in this connection, that the dew to which these weevils had access was collected the first morning following the application of arsenates and only from leaves which showed a relatively heavy coating of the poison.

Summary

1. The mortality among boll weevils on cotton plants treated with lead and calcium arsenates and kept protected from all rain and dew was appreciably higher than the mortality on plants similarly treated but exposed to dew and normal precipitation. As the presence of dew or rain water on the cotton plants does not increase the effectiveness of either lead or calcium arsenate as a boll weevil poison it is evident that mortality from the use of either of these poisons is brought about by ingestion of the poison with the weevil's food and not by drinking the so-called "poisoned dew."

2. Dew collected from cotton plants treated with lead arsenate at the rate of approximately 8 pounds per acre was found, upon analysis, to contain 6.7 parts of arsenic per million. Dew from plants treated

with calcium arsenate at the same rate was found to contain from 10 to 43.5 parts of arsenic per million. The dew was collected only from cotton leaves that showed a distinct, thorough white coating of the arsenates.

3. Boll weevils deprived of all food and having dew from treated plants as the only source of moisture suffered a greater mortality than boll weevils confined on clear water, showing that the dew contained sufficient arsenic to produce death when the weevils were *compelled* to take the dew and no other food or water over a period of several days. However, such a condition does not occur in cotton fields.

4. When boll weevils had access to food in the form of non-poisoned cotton squares and, at the same time, to dew from treated plants, no mortality resulted, showing that the weevil can be poisoned under normal conditions only by poisoning its food.

Conclusions

1. As the boll weevil is poisoned largely or entirely through taking poison with its food, machinery for applying poison to the cotton plants should be so designed as to apply the poison primarily to the squares, bolls and terminal buds, rather than to the foliage.

2. The greatest mortality among the boll weevils occurred on the third day following application of the arsenates and fell off rapidly after the seventh day indicating that, other things being equal, applications should be at intervals of a week, or less, apart.

President W. C. O'Kane: Do you wish to discuss this paper?

Mr. E. G. Kelly: Did calcium arsenate burn the tender foliage?

Mr. Wilmon Newell: I am not able to answer this question positively. In our experiments, it did not.

Mr. W. D. Pierce: I would call attention to the fact that in all of Mr. Newell's experiments, lead arsenate proved more effective than calcium arsenate. I would like to ask him as to the method of application that he found the most successful.

Mr. Wilmon Newell: In the case of both lead and calcium the highest efficiency was the method of application that forced the poison directly on the plants, as compared with distributing it in the form of dust clouds and allowing them to settle.

Mr. R. N. Chapman: I would like to ask how large numbers those percentages of mortality are based on.

Mr. Wilmon Newell: In the first table, in the protected cages, there were 250 weevils, and in the cages exposed to the rain and dew, there were 500 weevils.

Mr. R. N. Chapman: Do you think there would be any advan-

tage in applying the poison in a blast or cloud and putting it on the plants when they are wet?

MR. WILMON NEWELL: We have also tabulated the data so as to get information on that point. The mortality when the poison is applied to the wet plants is a little higher during the first 48 hours than when applied to plants that are dry. During the first four days, the mortality was practically the same in both cases.

MR. F. L. THOMAS: I am glad to hear this paper, as it shed new light to those who are carrying on similar experiments. In Alabama, in 1918, we carried out one test, the details of which I cannot recall, but in the cages that were treated, the one that was not exposed to dew had a greater mortality than the one that was.

PRESIDENT W. C. O'KANE: The next paper is entitled "Miscellaneous Soil Insecticide Tests," by J. J. Davis.

MISCELLANEOUS SOIL INSECTICIDE TESTS

By JOHN J. DAVIS, *Riverton, N. J.*

(Summary; Complete Paper to be Published Elsewhere)

Of the several materials tested against soil-infesting grubs, only emulsifiable creosote compounds, kerosene emulsion and sodium cyanide have given appreciable results.

Emulsifiable creosote compounds diluted 1 to 125 ("Carco" and "Barrett's Disinfectant" were used) and 10 per cent kerosene emulsion gave about 80 per cent kill for grubs of *Cotinis nitida* and 30 to 70 per cent kill for *Popillia* and other grubs which do not have a definite open burrow. Sodium cyanide, however, gave the best kill and when applied at 110 to 165 pounds per 12,000 gallons of water per acre a 90 to 100 per cent kill was obtained under favorable conditions. It is cheaper than either of the other two materials and is easier to prepare than the emulsion. Sodium cyanide was tested against the grubs of *Popillia japonica*, *Cyclocephala immaculata*, *Macrodactylus subspinosus* and *Lachnosterna* spp., the first mentioned species apparently being more resistant to the action of the insecticide than the others.

MR. Z. P. METCALF: I would like to ask Mr. Davis to give us some idea as to how deep the insecticide penetrated the soil.

MR. J. J. DAVIS: We had a very good kill—from 80 to 95 per cent killed—when the grubs were not deeper than two inches. When they were below that we got a very unsatisfactory kill. This was with an application of 165 pounds of granular sodium cyanide, dissolved in 12,000 gallons of water to the acre.

MR. GLENN W. HERRICK: I would like to ask Mr. Davis what effect that material had upon sod land, and upon the future crops?

MR. J. J. DAVIS: At 165 pounds to the acre it sometimes burned the grass slightly, but it did not destroy it outright, excepting where there were holes and where the solution stood for a length of time.

There is no effect on any future crop; the cyanide disappearing within ten days to two weeks. We cannot apply it where there are growing, cultivated crops, like corn, without injury.

PRESIDENT W. C. O'KANE: The next paper is "Outline of Project Work in Extension Entomology," by E. G. Kelly.

OUTLINE OF PROJECT WORK IN EXTENSION ENTOMOLOGY

By E. G. KELLY, *Extension Entomologist of the Kansas State Agricultural College*[1]

Extension work in entomology means the carrying to the farmer, the ranchman, the gardener and the fruitgrower information as to the how, when and where of the methods of controlling his insects pests. In order to do this a definite plan must be made by the leader Furthermore, to put over a plan or project of so much importance as the one herewith presented it is necessary to have an effective organization. In Kansas we have such an organization in our Extension Service, namely the County Farm Bureau. Each County Farm Bureau has a county agent who is a member of the Extension Division. The extension entomologist, who is the leader of this project, is also a member. The county agent is the medium through which the entomologist reaches the farmers.

You will please note that the project deals first, with the combative period—meaning the time control measures may be effected—and second, with the educational period. The combative time may be during the active period of the insect or may be during the dormant period; the educational time should be any time convenient for a gathering of farmers.

Where there are a large number of county agents in a state, the time the entomologist can devote to each agent must be necessarily limited. In Kansas we have 60 county agents with the state divided into convenient conference districts. Definite dates are set on which to hold a conference each month; a special conference may be called any time in case of an emergency. The entomologist attends these conferences whenever it is desired and gives the county agents definite instruction as to handling the insect problem at hand. These conferences are held in the office of the Farm Bureau near the district center. The

[1] Contribution No. 53, from the Entomological Laboratory, Kansas State Agricultural College.

agent of this Farm Bureau furnishes fields, orchards or other necessary material for the demonstration to be given by the entomologist. Following the conference, the county agent then gives the necessary time to the project to cover his county. In cases of unusual activity of an insect the entomologist devotes 2 or 3 days to assisting the county agent in holding campaign meetings in his county, thus more definitely and thoroughly instructing the agent, and incidentally a few selected farmers, in the measures of control to be used.

The conferences throughout the state are held within as short a period as practicable. The time for the agents to begin work on the project is definitely determined and set so that all the agents in the several districts will be ready on or about the same date. Every county agent beginning the campaign at the same time, the publicity department of the college can send out news items to all big newspapers, the local newspapers and to the farm papers. In a very short time every farmer is talking, thinking and working on the project.

The conference plan of seeing the county agents, means that the entomologist will see 50 to 60 agents in 6 days or less; each agent will see his insect committee consisting of 20 to 25 farmers in his county during the next 3 to 4 days. Thus in this manner 1,000 farmers who are leaders of the insect projects in the state are fully informed within 6 to 10 days.

The educational part of the project is divided into four parts: first, the follow-up; second, the county fairs; third, the farmers' institutes; and fourth, the extension schools. The follow-up program is that part of the work done by another department of the Extension Division, known as the home study department. The entomologist writes one or more short lessons on the subject which he is demonstrating to the county agent and farmers. The home study department then sends a mimeographed copy of these lessons to every farmer in the county immediately after the agent and entomologist complete the two or three day campaign.

The county fairs afford opportunity to show results of insect control, especially on fruit and garden truck and for meeting many farm men and women not otherwise available. The farmers' institute permits the meeting of many people. Here the extension school is advertised and what can be done at such school indicated. The extension school in Kansas is of from 3 to 6 days duration and is for farm men and women. A few pertinent lessons are given on timely subjects, allowing the entomologist to instruct a few men and women on definite problems. It has often been observed by extension workers that 25 men in a community taught a lesson is the means of the dissemination of that lesson to 150 to 200 men in a very short time.

PROJECT—ENTOMOLOGY

Combative month	Name of insect	Time allotted to project		Educational		Month
		Days for entomologist	Days for county agent	Follow-up subject matter lesson sheets	Ext. schools, farmers' insts. county fairs	
June July Aug. Sept.	Hessian fly	County agent conferences 6 days; with each county agent 1 to 3 days for meetings if pest unusually bad	14 to 20 days organizing and instructing farmers on methods of control	1. Life history and habits 2. Seasonal history 3. Control measures 4. Plants attacked 5. Bulletins		Oct. Nov. Dec. Jan. Feb.
Nov. Dec. June July	Chinch bug	County agent conferences 6 days; with each county agent 1 to 2 days for meetings when pest is unusually bad	14 to 20 days in fall; 14 to 20 days in spring organizing and instructing farmers on methods of control	1. Life history and habits 2. Seasonal history 3. Control measures (a) Fall burning (b) Barriers 4. Plants attacked 5. Bulletins		Oct. Nov. Dec. Jan. Feb.
March April May	Green bugs	County agent conferences 6 days; continuously in infested fields during outbreak	14 to 20 days continuously during outbreak	1. Life history and habits 2. Seasonal history 3. Methods of control 4. Plants attacked 5. Bulletins		Nov. Dec. Jan. Feb.
March April May June July Aug. Sept.	White grub	With each agent in infested district 1 to 3 days for meetings	As many days as needed to cover infested district	1. Life history and habits 2. Seasonal history 3. Crops attacked 4. Methods of control 5. Bulletins		Nov. Dec. Jan. Feb.
March April May June	Cutworms	County agent conferences 6 days; with each agent in infested district 1 to 2 days for meetings	14 to 20 days organizing and instructing farmers on methods of control	1. Life history and habits 2. Seasonal history 3. Crops attacked 4. Methods of control 5. Bulletins		Nov. Dec.
April May June July Nov. Dec.	Grasshoppers	County agent conferences 2 days; with each agent in infested district 2 to 3 days for meetings	10 to 20 days organizing and instructing farmers on methods of control	1. Life history and habits 2. Seasonal history 3. Crops attacked 4. Methods of control 5. Species involved 6. Bulletins		Oct. Nov. Dec. Jan. Feb
June July Aug. Sept.	False wireworms	County agent conferences 2 days	5 days organizing and instructing farmers on pest	1. Life history and habits 2. Seasonal history 3. Crops attacked 4. Methods of control 5. Species involved		Oct. Nov. Dec. Jan. Feb.
May June July Aug.	European corn borer	All of time in all situations	Continuously on guard	1. Life history and habits 2. Special instructions to county agents and farmers as to possibility and method of its being introduced into Kansas 3. Plants attacked 4. Bulletins		Nov. Dec. Jan. Feb. March
April May June July Dec. Jan. Feb. March	Fruit insects: Codling-moth San José scale Canker Worm Curculio Apple Aphis Apple leaf skeletonizer Apple leaf hopper Apple-tree borer Peach-tree borer	With each agent in April 4 days; in May 4 days; in June 2 days; in September and October roundup; judging results in orchards and exhibits at county fairs 2 to 3 days; orchard tours 6 to 8 days	8 to 10 days organizing orchard clubs, etc., for pruning and spraying demonstrations	1. Life history and habits 2. Spraying schedules 3. Insecticides and fungicides 4. Orchard management 5. Bulletins		Sept. Oct. Nov. Dec. Jan. Feb.

PROJECT—ENTOMOLOGY—*Concluded*

Combative month	Name of insect	Time allowed to project		Educational		Month
		Days for entomologist	Days for county agent	Follow-up subject matter lesson sheets	Ext. schools, farmers' insts. county fairs	
March April May June July	Garden insects: Potato beetle Blister beetle Stalk borer Cabbage worm Cutworm Aphis Striped cucumber beetle		5 or 6 days	1. Life history and habits 2. Spraying and dusting 3. Management 4. Bulletins		Nov. Dec. Jan. Feb.
June July Aug. Sept.	Insects affecting stored products: Weevil Angumois grain moth	With each agent in territory affected 1 day	6 days	1. Life history and habits 2. Methods of control 3. Bulletins		Nov. Dec. Jan. Feb.
May June July Aug. Sept.	Insects affecting livestock: Stable fly Bot fly Horn fly Lice Screw worms Ticks Scab mite	County agent conferences 8 days; in county where affected seriously 1 or 2 days	County agent 10 days	1. Life history and habits 2. Animals attacked 3. Methods of control 4. Bulletins		Nov. Dec. Jan. Feb.
April May June July Aug. Sept.	Insects affecting the health of man	Entomologist in coöperation with home demonstration agent; in each county 2 to 3 days.	20 days	1. Life history and habits 2. Control measures 3. Methods transmitting disease 4. Bulletins 5. Lectures		March April May June July Aug.

PRESIDENT W. C. O'KANE: The next paper is "Two 'Spray Your Orchard Week' Campaigns in Mississippi," by R. W. Harned and O. I. Snapp.

TWO "SPRAY YOUR ORCHARD WEEK" CAMPAIGNS IN MISSISSIPPI

By R. W. HARNED and OLIVER I. SNAPP

The San José scale was first introduced into Mississippi and other southern states in 1891, and since has been allowed to spread and increase without any attempt on the part of deciduous fruit growers in this region to check its progress, until 1917, when it was safe to say that from 85 to 90 per cent of all deciduous fruit trees in the state of Mississippi were more or less infested with the pest. .

The terrible devastation of Mississippi orchards by this pest, and the decided lack of a general knowledge of spraying throughout the entire state led us to take some vigorous step to correct these conditions. A "Spray Your Orchard Week" campaign was, therefore, organized during the summer of 1917, and December 9–15 designated as the special spray week. This was a part of the program for stimu-

lating food production during the emergency. The aim of the campaign was to influence every farmer in Mississippi who had an orchard to spray it for San José scale.

A meeting of representatives of the various spray machinery and spray chemical manufacturers with the horticulture, entomology and other coöperating departments of the Mississippi A. and M. College was the first step toward organizing the campaign. The meeting was held at the college on August 21. The chief purpose was to find out what these manufacturers and jobbers could do to aid in the movement. At this meeting a number of spray pumps were offered as prizes from various manufacturers, and the types of outfits for various size orchards were adopted. Suggestive talks were made by both college and factory officials.

The next step included an interview with the governor who issued a proclamation to the people of the state proclaiming December 9–15 as "Spray Your Orchard Week." The annual meetings of the Mississippi Retail Hardware Dealers Association and the Mississippi county health officers were attended at which resolutions were passed assuring their coöperation.

Publicity was given the campaign during the fall at the various fairs of Mississippi and neighboring states at which "Spray Your Orchard Week" booths were established and spraying demonstrations held. The Chambers of Commerce and Boards of Trade of the larger towns gave valuable publicity, as did the daily press and farm magazines. Some of the farm papers put on a special "Spray Your Orchard Week" issue.

The county agent was made the leader of the campaign in his county, and the home demonstration agent assistant leader. Arrangements were made whereby every agent in the state had a spray pump for this week. A personal visit was made to each county of the state before the campaign to assist in the organizing. The county health officer gave his services during the week to give talks on fruit and health at the demonstrations. The state superintendent of education requested the use of a specially prepared spray booklet in all of the schools of the state during spray week, and the agricultural high schools gave demonstrations in the school communities. The county superintendents of education gave their time during the week to the agents for short talks at demonstrations. The twelve thousand Mississippi club boys and the ten thousand club girls with their state leaders assisted materially with the campaign as did also the entire state extension force. The railroads loaned their agricultural agents for the week to assist in the work, and rendered other valuable assistance as did the bankers, rural clubs, nurserymen, state department of agriculture, and the experiment station and its branches. The hard-

ware dealers exhibited window displays of spray outfits, etc., during spray week. Posters, letter stuffers, and stamps on letters from the various departments of the college, announcing the campaign, also gave much publicity to the movement. For the agents, both men and women, making the best record during the week spray pump outfits were offered as prizes.

The campaign was opened on Sunday when the various ministers of the state used an outline sermon prepared by ministers of the respective denominations, which contained some reference to the campaign. In a systematic way spraying demonstrations and meetings were held in every community of each county of the state during the week under the direction of the county agent or his assistants. A chart was used at each demonstration discussing the fundamental principles of spraying and spraying operations, and some county official was usually present who made an address. A specialist was also on hand at a number of the meetings and demonstrations.

The results accomplished from this first campaign were amazing. Spray pumps could be found in every community of the state either owned by individuals or community clubs and each community had a decided knowledge of the San José scale, and means of controlling it. The scale infestation as a whole most certainly was materially decreased throughout the state. The sale of spray pumps and equipment in the state of Mississippi by one of the largest pump manufacturers in this country showed an increase of 37 per cent during 1918 as compared with the previous year. There was a likewise material increase in the sale of insecticides in the state, and during 1918 they could be found in practically every town in the state where they had not been for sale heretofore.

Such excellent results were obtained from the first campaign that it was decided to put on a follow-up campaign during the winter of 1918–19. Practically the same means of organizing were used in the second campaign as in the first, only the dates were changed to February 9–15. Louisiana had seen the value of such a movement, and decided to join us in our second campaign. The dates were moved forward so as to give the sister state sufficient time to organize.

The second campaign was equally as successful in Mississippi as the first. One manufacturer reports an increased spray pump sale in Mississippi of 40½ per cent during 1918–19 as compared with the previous year and 134 per cent increase over the sales in 1916–17, before the first campaign. Others report an increase of 50 per cent and better. One dealer of insecticides states that their sales are now a nice part of their business, whereas they were practically nothing prior to the first campaign. A well-known manufacturer of insecticides reports an increased sale since the campaigns from practically nothing to $5,000 per year.

PRESIDENT W. C. O'KANE: The next paper is by W. O. Hollister, on "The Distribution of Shade Tree Insects in 1919."

DISTRIBUTION OF SHADE TREE INSECTS IN 1919

By W. O. HOLLISTER, *Kent, Ohio*

This subject, the distribution of shade tree insects in 1919, is a very broad one for if every shade tree insect which appeared were mentioned this discussion would be very lengthy indeed. Only the most important pests are considered and the territory covered has rather definite limits, covering in a general way the country east of the Mississippi River and north of the Mason-Dixon line, but more especially that territory around the larger cities of Chicago, Cincinnati, Detroit, Cleveland, Pittsburgh, Washington, Philadelphia, New York, Newport and Boston.

The source of information is not entirely first hand. It was secured mostly from reports sent in by the experts of the company which I represent, men who had the opportunity of coming in personal contact not only with shade trees but with the insects themselves. The men sending the reports have had some training in entomology and considerable training in the care and preservation of shade trees. Their reports, as well as those from gardeners of private estates, were supplemented to a limited extent by reports from state entomologists. Twice during the season, the first of July and the first of October, a list of about forty insects was sent out with a request for information regarding their abundance, and from these reports, totaling about one hundred and fifty, this paper is compiled.

It would be difficult to say just what insect was most abundant or the one causing the most injury to shade trees this year. Judging from the reports which were received no insect appeared to be especially serious. Without question though, the most abundant insect was the aphid, and it was everywhere. The fruit grower with his systematic spraying and careful attention to his orchard should have no trouble in controlling these little pests but the shade trees are usually neglected and the aphids run wild. Few trees are immune from their attacks and many of our finest shade and ornamentals are hosts of one or more species. One very conspicuous aphid was the woolly beech leaf aphid, *Phyllaphis fagi* Linn., on the beeches, especially the copper beech, *Fagus sylvatica*, variety *purpurea*. The attention of the estate owner might have been called to the trouble by the shiny appearance of the leaves caused by the honey dew or by the whitened appearance of the underside of the leaves. Now it is probably true that with a few exceptions no one species of insect will kill a shade tree, still they

lower its vitality and make it susceptible to the attack of other insects or fungous diseases. Hence the importance of caring for shade trees even though the pest be small. There were numerous other aphids reported but they have been classed together with the exception of the maple phenococcus, *Phenococcus acericola*, which was quite conspicuous in northern Virginia. This species was also noticed in northern Ohio.

Of the scale insects found on shade trees this year the oyster scale, *Lepidosaphes ulmi*, was probably the most abundant. In nearly every section it was reported on ash, carolina poplar, willow and other shade trees. In many cases the limbs were coated over with these insects, so much so, that the men were handicapped when climbing because of the slippery limbs. The San José scale is not generally found upon shade trees other than fruit trees which may be growing in gardens or lawns. It is often found upon the mountain ash, and was so reported from Pittsburgh and Corning, N. Y. The pine leaf scale, *Chionaspis pinifoliæ*, was numerous at Detroit, in northern Ohio, Pittsburgh, Connecticut, and noticed at Albany, around New York, and Boston. The tulip scale, *Toumeyella liriodendri*, was noticed occasionally and was reported abundant from Washington to Philadelphia, in northern New Jersey, and numerous along the Hudson River and around Boston, and noticed in other places. The principal scale on the elm is the elm scurfy, *Chionaspis americana*. At Chicago, Pittsburgh, around New York and at Boston it was abundant. Another elm scale, *Gossyparia ulmi*, was plentiful near Poughkeepsie, N. Y., numerous at Albany, Pittsburgh, Cleveland, and Detroit and noticed in Connecticut and at Boston. The cottony maple scale, *Pulvinaria vitis*, is the worst scale on the soft maples and as these trees are planted in every section this insect is very common. Nearly every report mentioned this scale. At Chicago, Detroit, Pittsburgh, Baltimore, New York, and in Connecticut it was very abundant while it was more or less common around Boston, Philadelphia, Cleveland, and Cincinnati. The golden oak scale, *Asterolecanium variolosum*, was quite serious at Philadephia last spring.

None of the leaf eating insects were reported as especially destructive this year. The canker worms, however, were bad last spring in northern Ohio as well as at Detroit. At Cincinnati, Pittsburgh, around New York, and Boston they were also quite common, and noticeable in northern Virginia and in Maryland. The cottonwood leaf beetle, *Melasoma scripta*, was reported from Long Island and along the Hudson River. *Euvanessa antiopa* caterpillars were reported from Detroit and Boston. The bag or basket worms, *Thyridopteryx ephemeræformis*, were conspicuous in New Jersey at Red Bank, as well as south into Maryland and Virginia. They were also reported from

Cincinnati and from southern Illinois. This insect is common, of course, only in the southern limits of these observations. The black walnut caterpillars, *Datana integerrima*, were quite abundant at Detroit and Newport, R. I., and numerous at Chicago and Cincinnati. They were reported also from around New York, Baltimore and Pittsburgh. The elm leaf beetle is still with us, being reported abundant this year from Newport, eastern Connecticut, around New York, including Long Island and northern New Jersey, and numerous at Boston, Albany and at Cincinnati. The elm leaf miner was in evidence at Pittsburgh, Baltimore, Long Island and Boston and noticed at Detroit. The elm case bearer, *Coleophora limosipennella*, showed up in northern New Jersey, Long Island and along the Hudson River. In northeastern Ohio the fall web worm, *Hyphantria cunea*, seems to be on the increase. It was serious in Detroit, Pittsburgh, Cincinnati, northern New Jersey and along the Hudson River. At Philadelphia, Boston, Albany, and Chicago it was quite common. On Long Island and up the Hudson the locust leaf miner, *Chalepus dorsalis*, did some injury as well as working in Newport, Philadelphia, Baltimore, Pittsburgh, and Cincinnati. Only one caterpillar of the tussock moth, *Hemerocampa leucostigma*, was found at Kent, Ohio, where two years ago trees were defoliated. At Cleveland, however, they were quite conspicuous. They were also reported from Connecticut, Brooklyn, Wilmington, and Chicago as abundant and numerous at Boston, Albany, Long Island, Cleveland and Detroit. A few leaf eaters were reported feeding upon the conifers, but none of them were doing any apparent injury with the possible exception of the larch sawfly in northern New Jersey.

The insects which are most noticeable to our men and which are in many cases the most destructive are the borers. This term is generally applied to those forms which confine their depredations to the interior part of the tree, either the roots, trunk, branches, or twigs. Because of their internal operations their work is often not noticed until a tree is in a serious condition. With a few exceptions borers seem to prefer trees with a lowered vitality. The hickory bark borer, *Eccoptogaster quadrispinosus*, and the bronze birch borer, *Agrilus anxius*, are good examples. The former can kill a tree in less than twenty days. These pests are killing the hickories by the thousand every year although in the east it is reported that they are not as serious. Reports from around New York, Pittsburgh, Cleveland, and Detroit were that the beetles were very bad this year while at Newport, Baltimore, and Chicago they were quite numerous. The bronze birch borers are gradually killing the white birches. They were reported serious from northern New Jersey, quite noticeable from Newport, Poughkeepsie, N. Y.,

and Cleveland, and present at Boston, Detroit, and Chicago. The carpenter borer, *Prionoxystus robiniæ*, is a steady worker, being plentiful this year around New York, Pittsburgh, and Detroit, and noticed at Boston, in Connecticut, Baltimore, Cleveland, and Chicago.

As a bark borer, *Eccoptogaster multistriata*, on the elm was reported a number of times from along the Hudson River and in northern Virginia. At Boston, Cleveland, Detroit, and Chicago, these borers were quite numerous. The locust would be a more valuable tree if it were not for the borer, *Cyllene robiniæ*, which this year was quite conspicuous at Newport, around New York, and especially on Long Island, at Philadelphia, Baltimore, Pittsburgh, Detroit, and Cincinnati. The locust twig borer, *Ecdytolopha insiticiana*, was reported from Long Island, northern Virginia and near Cleveland. The leopard moth, *Zeuzera pyrina*, was found only at Boston, Newport, and Long Island. The sugar maple borer, *Plagionotus speciosus*, was quite abundant in northern New Jersey and along the Hudson as well as in Connecticut, and down the coast to Philadelphia, at Pittsburgh, and Cleveland. While at Boston and Chicago evidence of its work was found. The maple sesian, *Sesia acerni*, seems to prefer the soft maples and is usually found hindering the growth around wounds. It was quite common in Connecticut and along the Hudson, at Philadelphia, Detroit, and Chicago.

The twig pruner, especially *Elaphidion villosum*, is often injurious to a tree but usually the objection is the unsightly appearance of the tree or the lawn beneath. From Albany to Washington they were very conspicuous, as well as at Newport, Detroit, and Chicago. Around Chicago the two lined chestnut borer, *Agrilus bilineatus*, was injuring oaks this year. It was also reported from Albany and Long Island. One of the most common insects found in cavities in trees is the black carpenter ant, *Camponotus* species. Give them an opening and in they will go and by making tunnels and galleries, they quickly weaken a tree structurally. They were reported abundant from Boston to Baltimore and numerous from Pittsburgh to Chicago. The red spiders, *Tetranychus* sp., seem to be causing increasing injury to oaks, maples, and beeches. They were fairly abundant in every section.

This, then, in a brief way, is the distribution of the shade tree insects in 1919.

DR. L. O. HOWARD: I would like to ask Mr. Hollister, if the where canker worms were abundant, he found they were eaten by birds.

MR. W. O. HOLLISTER: That was noticed at Kent, Ohio.

PRESIDENT W. C. O'KANE: The next paper is on the "Control of the Codling Moth, with Spray-Gun, Rod, and Dusting Method—Three-Year Tests," by LeRoy Childs.

THE CONTROL OF THE CODLING MOTH WITH SPRAY-GUN, ROD AND DUSTING METHOD

By LEROY CHILDS, *Hood River, Ore.*

(Paper not received)

Adjournment.

Scientific Notes

European Corn Borer in Broom Corn. Early in February, 1920, a shipment of broom corn infested by the European corn borer was received at New York from Venice, Italy. This consignment was intercepted by Mr. H. B. Shaw, inspector for the Federal Horticultural Board. The broom corn originated in the territory of Venetia, Northern Italy, and consisted of 97 bales, each weighing about 200 pounds.

Upon examination it was found to be infested to a considerable degree, the percentage being somewhere between 1 per cent and 5 per cent of the stalks. Large, nearly full grown larvæ as well as pupæ in a live and healthy condition were found. These larvæ were determined by Mr. Heinrich, of the U. S. National Museum, as *Pyrausta nubilalis* Hubn.

The broom corn stalks were about 36 inches long, of which at least 15 inches consisted of the butt. The larvæ were found throughout the length of this butt and in most instances had extended their tunnels into the extreme upper tip of the terminal internode, beyond the point where the hurls are given off.

This incident obviously strengthens the belief already held that broom corn was the host in which the European corn borer gained access to this country, and apparently established the evidence submitted by Mr. Harrison E. Smith, in his paper appearing in the next number of this JOURNAL entitled, "Broom Corn, the Probable Host in Which *Pyrausta nubilalis* Hubn. Reached America."

W. R. WALTON.

Aphids and Coccids. Species of both are of considerable economic importance. As many of the American species are identical with or closely allied to European, it is doubtless desirable to have material of European species for comparison ready at hand. From the correspondence that I have had with a number of American colleagues since the conclusion of the war, I see that this desire actually exists. Doubtless the study of aphids and coccids will be considerably advanced in the presence of such comparison material. As I have during recent years extended my studies also to these insect groups, it will be no difficult matter for me to satisfy these desires. I wish to announce that I will gladly undertake to furnish such material to interested American colleagues and by means of this circular I am addressing a call to the Experiment Stations and specialists for the attention of those that wish to get in touch with me. The distribution of the material will be entirely gratis. By way of reciprocity, I should like to have the stations place my name on their regular mailing lists of their publications.

F. SCHUMACHER,
Charlottenburg-Berlin IV, Mommsenstr. 53–54, Germany.

Note on Eriopyga incincta Morr. A cutworm-like caterpillar, later identified as *Eriopyga incincta* Morr., was abundant at Wichita, Kan., during the spring of 1918. It was not found at other Kansas points visited, nor was it observed among cutworms found during three previous years at Wichita. Cutworm injury developed suddenly, and was a source of complaint from about April 10 until late in May. *Feltia subgothica*, usually the commonest species, was scarce except in a few spots where favorable conditions existed. *Eriopyga incincta* was the most numerous species, and seemed to be responsible for a great deal of injury. It was found in great numbers in small areas in alfalfa and about the edges of gardens, and in one instance 25 larvæ were taken in a bed of pole beans in which the plants were just coming up. The larvæ were not observed actually feeding, but there was considerable cutworm injury in that vicinity and it is probable that both alfalfa and beans were affected. The specimens obtained were hidden in surface trash or loose soil, in just such places as are most affected by cutworms.

The larva is clean-looking and distinctly marked, in sharp contrast to the dull appearance of *Feltia subgothica*. It is a smooth, glistening caterpillar, dark gray to black, with an irregular brown mid-dorsal stripe. The ventral surface is lighter, the tubercles glistening black.

The pupa is of the ordinary cutworm type, and of a reddish brown color. It is slightly duller in luster, and more reddish in color, than most cutworm pupæ.

Larvæ were half-grown or larger by April 15, and full-grown in May. A larva was seen preparing to pupate May 20. A few pupæ were present May 27. About one-third of those in the field, and two-thirds of those in the insectary, had pupated June 1. Nearly all were pupæ by June 8, all by June 15. The first adult appeared August 19, but no more emerged until September 11. From September 11 to 20, 22 adults emerged; from September 21 to 26, 17 emerged. No adults appeared after this date. The moths were confined in a cloth-covered cage, and food supplied, but no eggs were deposited. The pupal period is from three to four months in length, and includes the hot season. The length of the egg and larval stages, and the hibernation stage, are not known. From the size the larvæ had attained in April, it seems probable that the species hibernates in the larval stage.

F. M. Wadley, *Muscatine, Iowa.*

Two Rhynchophora Found Feeding in Sweet Potatoes. During the past year many reports have come from various parts of this state (Louisiana) in regard to insect damage done to sweet potatoes while in the soil. Most of this damage is supposed to be caused by the sweet potato weevil (*Cylas formicarius* Oliv.) but two cases which have come to my notice were caused by *Xyleborinus pecanis* Hopk. and *Platypus compositus* Say.

In the case of the former the beetles made straight, clean cut burrows, which were usually from one to two inches long, whereas in the case of the latter the burrows were partly filled with material the exact nature of which was not noted.

Fields or patches of sweet potatoes which are infested with the above beetles are usually surrounded by trees, adjacent to trees, on at least one side, or on newly cut-over land.

Determination of beetles by Dr. A. D. Hopkins.

O. W. Rosewell,
Louisiana State University.

Anasa Tristis DeG. (Hemiptera) Feeding on Leaves and Fruit of the Fig Tree. On August 16, 1919, while walking through a lane between two farms, located about two miles from New Roads, La., I noticed that the leaves on a row of fig trees along

one side of the lane appeared blotched and yellow. A closer examination showed that there were numerous adult specimens of *A. tristis* DeG. as well as various other stages of this insect. On many leaves there were from five to ten specimens. There were five nymphs feeding on a single fig.

From the above observation I concluded that this was a real infestation of fig trees by *A. tristis* DeG., because there were no cucurbit vines within one hundred yards.

O. W. ROSEWALL,
Louisiana State University.

To Keep Out Cane Butterfly. Because of the financial loss suffered by sugar centrals in Porto Rico from the rapid spread of the cane mosaic (yellow stripe) disease, strong efforts have been made by them to secure permission to introduce seed cane from Santo Domingo, with the hope to overcome the disease. Such a course would result in grave danger of introduction of the Santo Domingo cane butterfly, *Calisto archebates* Men., a pest whose larvæ literally strip the leaves from hundreds of acres of sugar cane in that island during the winter months. The introduction of this pest into Porto Rico, where already the May-beetles and weevil root-borer (*Diaprepes spengleri* Linn.) cause great annual loss to cane, would be a calamity beyond hope of reparation.

Federal quarantine regulations against sugar cane introduction do not, unfortunately include protection to Porto Rico, and the insular quarantine law permits introduction of plant products for manufacture or industrial purposes in such phraseology as to make difficult the inclusion of sugar cane under the ban of strictly prohibited products. However, the quarantine experts of the Insular Experiment Station took the matter in hand, presenting many arguments against the proposed cane importation and bringing all possible pressure to bear against the action, with result that the centrals of the island decided to give up the idea of introducing seed cane, and to use instead the cultural methods of combating the disease that have been advised by the station experts.

E. GRAYWOOD SMYTH.

The Porto Rico Mole-Cricket in South Carolina and Florida. The Porto Rico mole-cricket or "changa," which has been established in Georgia for a number of years where it is a troublesome pest, has made its appearance recently in South Carolina and Florida.

August 13, 1919, Mr. John C. Burrowes, Jacksonville, Fla., complained of this species, stating that it was known as a "cricket mole" and was playing havoc on some of the greens and fairways of the Florida Country Club. Carbon disulphid and arsenate of lead had been employed as remedies but without success. September 4 specimens were sent for identification which proved to be *Scapteriscus vicinus* Scud. They were obtained by plowing up the putting greens that the insects had destroyed. When the outbreak was first reported poisoned baits such as used for cutworms and grasshoppers were advised, and later Mr. B. L. Boyden investigated the infested region and reported that these baits were very successful.

Later in the same month a number of complaints were made of mole-crickets in the vicinity of Charleston, S. C., and the infestation was investigated by Mr. W. A. Thomas, working under the writer's direction. This proved to be the same species. It is known locally as "ground puppy," a name which is used for this and the short-winged mole-cricket in Georgia and in southern Florida, respectively. In a report on its occurrence rendered by Mr. Thomas October 21, he stated that the infestation covers an area of about 12 square miles and that it is spreading from year to year,

comprehending Charleston and much of the adjacent area of James Island and a considerable scope of the mainland across the Ashley River from Charleston. The truckers claim that the insect had appeared about five years ago or about 1914 and had rapidly increased in destructiveness until some truckers had been forced to abandon some of the chief crops of that region, among them spinach, carrots, beets, and lettuce. The cabbage industry is being seriously threatened at the present time. Poisoned baits were used as in the case of the Florida infestation, but without success. The failure can be attributed to the lateness of the season, as the baits were not applied immediately and the insects did not seem to feed at all during the latter part of October and later.

In looking over the correspondence of the Bureau of Entomology, the writer finds that this species was reported in two other localities in South Carolina in earlier years. October 1, 1915, Mr. T. R. Hamlin, Mount Pleasant, S. C., sent specimens, stating that the insect was a pest in seed beds and that he had been fighting a losing game with them for years. "Unlike our common destructive insects, the mole-crickets," he writes, "work in the open and infest the well-cultivated seed beds, causing during two or three previous seasons a 60 per cent loss." They were also described as destroying the tender shoots. The specimens in this case were identified by Mr. A. N. Caudell. March 1, 1917, Mr. R. H. Adams, Navy Yard, Charleston, S. C., reported this species feeding on seeds and young plants in that vicinity, but the specimens sent were immature and a positive identification could not be made at that time.

This species, it should be added, is best known in literature as *Scapteriscus didactylus* Latr.

F. H. Chittenden,
Bureau of Entomology, U. S. Department of Agriculture.

JOURNAL OF ECONOMIC ENTOMOLOGY

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The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. Photoengravings may be obtained by authors at cost. The receipt of all papers will be acknowledged.—Eds.

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This issue has been greatly delayed by unprecedented combinations of illness in the printing, not editorial office, abominably slow mail service and snow blockades following an unusual delay in the completion of the proceedings.

If nothing more were taken into account than the aid in defending farmers against insect pests, the appropriations made by the different states for the support of such efforts could but be regarded as very profitable. More than this, the agencies devoted to investigation and teaching have constructive value in opening the way, slowly to be sure, for more effective methods of handling the vast agricultural resources of the country. For these reasons careful consideration should be given by entomologists to what are their real needs if their activities are to develop in accordance with the demands made upon them. Moreover, a proper balance should be maintained between such efforts as investigation, instruction and inspection that they may proceed symmetrically. The foregoing remarks serve to introduce the question if the work of inspection and certification of insecticides should not receive more serious attention by entomologists. There is no escape from the fact that the field of insecticides is being energetically exploited in an increasing degree, with the result that there is now an amazing assortment of spraying materials on the market. The enactment of measures providing for more complete analyses and clearer explanation of the data than is now done, should prove beneficial to both manufacturers and farmers. Also, with conservative inspection

and emphasis placed on the educational features of the law in its administration, there should come about a marked improvement in the accuracy of the statements in advertising circulars and shipping tags. Surely, men with fundamental training in the subjects of entomology and chemistry have a large opportunity, and fortunate indeed is the entomological staff that is able to command their services. The need of research in the field of insecticides is too evident to be denied. The science which should guide workers in this endeavor is only in its infancy, and the most important problems are still to be solved.

P. J. P.

Compensation has very properly received considerable attention of late. It is a vital and most important problem and unless it is solved satisfactorily, there will invariably be a lowering of professional standards. The latest contribution along this line is an anonymous circular distributed by a group of younger entomologists. This details the unfortunate situation of a number of the younger men entering the work, who because of their love of science were content to accept inadequate compensation at the outset in the hope of material increases later. It is presumable that most young entomologists look forward to obtaining one of the more responsible positions, possibly fifty in number in this country, and are willing to take some chances. There are now over five hundred and fifty members of the Association, a large proportion being well-trained and within certain limits capable of filling any position. We should note in this connection that the eight past presidents attending the St. Louis meeting had an average age of 56 years, an average term of service of 31 years and the larger proportion of them would not rank as old men. These figures indicate an extended period of official activity, particularly in this class. In other words, there are many candidates and relatively few good positions with comparatively infrequent changes and capable assistants are absolutely necessary to a proper discharge of the numerous responsible duties falling to that class of men. Inefficient assistants reflect upon the chief and in the long run upon the entire service. Students should not be urged to enter entomological work without some idea of the actual prospects and those in administrative positions must see the imperative need of adequate compensation if satisfactory standards are to be maintained. Research for the sake of research is praiseworthy. It is belittling the spirit of justice and equality, supposedly American virtues, to expect service out of all proportion to the compensation and opportunities offered and this latter has been altogether too frequent in the last few years.

Obituary

MARIA E. FERNALD

"A Catalogue of the Coccidæ of the World," published as Bulletin 88 of the Hatch Experiment Station of the Massachusetts Agricultural College, with its 360 pages of technical names and citations, is a most fitting memorial of the scientific activities of Mrs. Fernald, who was gathered home October 6, 1919, having been permitted to live for a full four score years. Many of the entomologists trained at the Massachusetts Agricultural College will remember the cosy home on Hallock Street, a delightful center for both social and scientific activities.

Mrs. Fernald was born at Monmouth, Maine, May 24, 1839, the daughter of Ebenezer and Betsy (Torsey) Smith. She was graduated from the first class of the Maine Wesleyan Seminary and Female College, Kent's Hill, Maine, where she afterwards served as preceptress. She was married to her talented husband, Charles H. Fernald, August 24, 1862, and the couple lived in Litchfield, Houlton and Orono, Maine, before coming to Amherst in 1886.

Mrs. Fernald was deeply interested in scientific work and in the late seventies began a card catalogue of the Tortricidæ which became so useful that it was later extended to include all insects and one section was developed into the catalogue of the Coccidæ named above. This was only a portion of Mrs. Fernald's activities. She was a member of the Amherst Woman's Club, and took an active part in the social life of both the community and college. She is survived by her husband, Professor Charles H. Fernald; her son, Professor H. T. Fernald, and three grandchildren. E. P. F.

Current Notes

Conducted by the Associate Editor

Mr. Grover C. Matthews has been appointed assistant professor in beekeeping at the University of Minnesota.

Mr. John R. Eyer has been appointed instructor in economic entomology in the Pennsylvania State College.

Mr. George B. Newman has been appointed assistant in entomology at Purdue University and the Indiana Station.

The Ontario County (N. Y.) Beekeepers' Association arranged to hold a convention at Canandaigua, N. Y., on January 13.

Mr. W. E. Jackson, assistant entomologist of the Texas College and Station, has resigned to enter commercial work.

Mr. Julius W. Sauer has been reappointed assistant entomological inspector, Bureau of Entomology, with headquarters at Kingsville, Tex.

The annual convention of the National Beekeepers' Association was held at the Hotel Statler, Buffalo, N. Y., March 1 to 3.

The National Conference of delegates representing beekeeping organizations was scheduled for January 6 to 9 at the Muehlenbach Hotel, Kansas City, Mo.

Messrs G. W. Barber and D. J. Caffrey are now engaged in the preparation of a manual of Cereal and Forage Insects, which it is hoped will be completed in the near future.

The annual meeting of the Missouri Apicultural Society will be held the third week in January at the University of Missouri, Columbia, Mo.

The Wayne County (N. Y.) Beekeepers' Society held its third annual meeting at the Grange Building, Newark, N. Y., on January 30.

The annual meeting of the Washington State Beekeepers' Association was held in the hall of the Chamber of Commerce, Seattle, January 22 to 24.

The following resignations are announced in the Bureau of Entomology: C. F. La Grone, Baton Rouge, La.; W. B. Williams, C. H. Williams, boll weevil force.

A conference of federal and state workers employed in controlling the gipsy moth was held February 3, at 10.00 a. m., in room 408, State House, Boston, Mass.

Dr. Roger C. Smith of the United States Bureau of Entomology has resigned to accept the position of assistant professor of entomology in the Kansas State Agricultural College.

Mr. H. E. Loomis, assistant entomological inspector, Bureau of Entomology, who has returned from service in the Marine Corps, has been reappointed with headquarters at Macclenny, Fla.

Professor Herbert Osborn, Ohio State University, was elected a member of the executive committee of the American Association for the Advancement of Science, at the St. Louis meeting.

Dr. A. L. Quaintance, Bureau of Entomology, made an extended trip to the Pacific Coast, visiting various field laboratories attached to his division. He has now returned to Washington.

Mr. C. S. Anderson, of Harrisburg, Pa., was appointed September 1 to the Bureau of Entomology as entomological preparator for duty on the European corn borer investigations at Arlington, Mass.

Dr. W. J. Holland, director of the Carnegie Museum, Pittsburgh, Pa., gave the annual address before the Entomological Society of America at St. Louis on the evening of December 30, 1919.

Mr. Thomas H. Jones, entomological assistant, Bureau of Entomology, is in Florida, where a new station will be established for the investigation of the insects injurious to truck crops in that state.

Mr. C. H. Popenoe, Bureau of Entomology, entomologist in truck crop insect investigations, has spent the month in visiting the western stations of that branch, with particular attention to the Central Pacific states.

Mr. W. B. Wood, Bureau of Entomology, who has been assisting Dr. N. E. McIndoo in connection with insecticide investigations the past season, has been transferred to

the Federal Horticultural Board, and assigned to duty in the Plant Quarantine Greenhouse.

The New Jersey Beekeepers' Association held its annual meeting at Trenton N. J., January 15 and 16. Dr. E. F. Phillips, and E. G. Carr, secretary of the association, addressed the meeting.

Mr. Neale F. Howard, specialist in insects as carriers of plant diseases, has been reappointed in the division of truck crop insect investigations, Bureau of Entomology, and has established headquarters at Bowling Green, Ohio.

The Ontario Agricultural College at Guelph, Ont., held its tenth annual Short Course in Apiculture January 12 to 24. Messrs. F. E. Millen and George H. Rea were among the speakers.

Mr. John E. Graf, Bureau of Entomology, has returned to his headquarters at Macclenny, Fla., after a protracted visit at Ocean Springs, Miss., in connection with sweet-potato weevil eradication and experiments in control measures.

Mr. F. J. Brinley has been appointed by the Bureau of Entomology, truck crop insect investigations, to take charge of the field station at Greeley, Colo., a position made vacant by the resignation of A. E. Mallory.

Mr. M. D. Leonard and Dr. Robert Matheson, of Cornell University, have been granted appointments as field assistants of the Bureau of Entomology for special work in connection with the European corn borer investigations at Arlington, Mass.

The fifth annual meeting of the Tennessee State Horticultural Society, Nurserymen's Association, and Beekeepers' Association, was held at Nashville, Tenn., December 9 to 11, 1919. Professor G. M. Bentley is the secretary-treasurer of each of the three associations.

Dr. L. O. Howard, chief of the U. S. Bureau of Entomology, and for twenty-two years permanent secretary of the American Association for the Advancement of Science, was elected president of that association at the St. Louis meeting.

The New York State Association of Beekeepers' Societies held its annual meeting at the Joseph Slocum College of Agriculture, Syracuse University, February 3 and 4. Among the speakers were Dr. Burton N. Gates, George H. Rea, and E. G. Carr.

A conference on the European corn borer was held at Hartford, Conn., February 12, in connection with Farmers' Week. Invitations were sent to the official entomologists and commissioners of agriculture of the New England states, New York and New Jersey.

Dr. Burton N. Gates, formerly assistant professor of entomology in the Massachusetts Agricultural College, Amherst, Mass., who resigned to accept a position at the Ontario Agricultural College, Guelph, Ont., is now living in Worcester, Mass., and is again in charge of apiary inspection in Massachusetts.

Mr. A. L. Ford represented cereal and forage insect investigations of the Bureau of Entomology at the International Hay and Grain Show, Chicago, Ill., during the week of November 29 to December 6. Mr. Ford prepared and set up the exhibit of cereal and forage insects, which was exhibited at the show.

Mr. E. J. Hoddy severed his connection with the Bureau of Horticulture, Department of Agriculture of Ohio, on November 30, to accept a position with the Louisville and Nashville Railroad Company with headquarters at Knoxville, Tenn. Mr. Hoddy succeeds Mr. W. E. Evans who has entered private commercial work at Eustis, Fla.

Mr. George N. Wolcott, who was recently engaged to handle the entomological phases of the coöperative work between the Bureau of Entomology and the Bureau of Plant Industry relating to the possible insect transmission of the sugar cane mosaic disease, sailed for Porto Rico on November 24, to take up the work there.

A course for commercial beekeepers was held in connection with the annual meeting of the Ohio Beekeepers' Association, during Farmers' Week at the Ohio State University, Columbus, Ohio, from January 26 to 30. This course is in charge of Dr. E. F. Phillips and Mr. George S. Demuth of the Bureau of Entomology.

Mr. Melvin E. Wyant, a recent graduate of the Ohio State University, has been appointed a deputy inspector in the Bureau of Horticulture of the Department of Agriculture of Ohio to succeed Mr. Richard Faxon, who resigned some time ago to accept a position in the insecticide department of the Glidden Company of Cleveland, Ohio.

Major L. H. Dunn has recently resigned from the United States Army, having served for some time in France, where he was in charge of delousing men and equipment. He has just accepted a position as entomologist to the League of Red Cross Societies with headquarters at Geneva, Switzerland, though he expects that most of his work will be in Poland.

R. R. Parker, Assistant State Entomologist of Montana, has been appointed a member of a North American commission of three experts to investigate the spread of typhus fever in Russia and Poland. He sailed from New York about January 15 with the understanding that he was to be released in April to resume his work in this country.

Wilmon Newell, plant commissioner of Florida, was tendered a complimentary dinner at Gainesville, January 12, by a number of his associates, in honor of his election as President of the American Association of Economic Entomologists. The following institutions were represented: State Plant Board and Board of Control, Faculty of the University of Florida, Staff of the Experiment Station, Staffs of the General Extension Division and of the Agricultural Extension Division of the University of Florida and Staff of the State Plant Board. There were 54 present, Hon. J. B. Hodges, chairman of the State Plant Board and Board of Control acted as toastmaster.

According to the Experiment Station Record, announcement was recently made in Parliament of a change in policy in 1918 regarding research in entomology and plant pathology through public funds. These subjects were originally allocated to the University of Manchester and the Royal Botanic Garden at Kew, respectively, with grants from the Development Fund for their support. In 1918, however, the Development Board decided that all research in plant diseases, whether due to insects or fungi, should be concentrated at a single phytopathological institute at Rothamsted, where also the board's scientific advisory staff in the subject would be stationed. Accordingly the staff at Manchester and a portion of the mycological staff at Kew were transferred to Rothamsted. A grant of $5,000 per annum was, however, continued to the University of Manchester to maintain certain phases of its entomological work and also to take up work in mycology there.

An enjoyable dinner was held by the entomologists at the St. Louis Athletic Club on New Year's night. This was the first time that the entomologists have held a dinner, and it is likely to become an annual event. Eight ex-presidents were seated together at the table with the president, Professor W. C. O'Kane, who called attention to the fact that their combined age was 452 years, and that their combined period of

service amounted to 252 years. There was no formal program, but Dr. Howard was asked to take charge of ceremonies, and he read a very interesting letter, both pathetic and humorous, from Professor Josef Jablonowski, of Budapest, Hungary, then called upon each of the following entomologists for a few remarks: Professor S. A. Forbes, Urbana, Ill.; Professor Herbert Osborn, Columbus, Ohio; Dr. E. P. Felt, Albany, N. Y.; Dr. W. E. Britton, New Haven, Conn.; Mr. C. L. Marlatt, Washington, D. C.; Professor P. J. Parrott, Geneva, N. Y.; Dr. E. D. Ball, Ames, Iowa, and Mr. Wilmon Newell, Gainesville, Fla.

A conference of entomologists to discuss the European corn borer situation was held at the Hotel Statler at St. Louis, on the evening of January 1, 1920, on invitation of Mr. C. L. Marlatt. Certain entomologists in attendance laughingly referred to this conference as a celebration of the twentieth anniversary of the reading of Mr. Marlatt's paper, "The Laissez-Faire Philosophy Applied to the Insect Problem." Though no very definite action resulted from this conference, it cannot be said to be of no benefit, as the varying viewpoints were explained and discussed. The following were present: R. H. Allen, E. D. Ball, G. M. Bentley, S. W. Bilsing, W. E. Britton, A. F. Burgess, E. C. Cotton, G. H. Dean, E. P. Felt, W. P. Flint, S. A. Forbes, S. B. Fracker, P. A. Glenn, L. Haseman, T. J. Headlee, J. S. Houser, E. G. Kelly, Wilmon Newell, W. C. O'Kane, Herbert Osborn, P. J. Parrott, A. G. Ruggles, J. G. Sanders, Franklin Sherman, Jr., M. H. Swenk and W. R. Walton.

It will be of interest to members of the Association of Economic Entomologists to learn that Dr. Paul Marchal, of Paris, has recently been elected member of the *Academia dei Lincei* of Rome and of the Academy of Sciences of Brussels. It should be a matter of pride to all entomologists, and especially to economic entomologists (for Doctor Marchal is distinctly an economic entomologist, and is, by the way, a foreign member of this Association), that these great honors should have been conferred upon one of their number. It is one of the rapidly accumulating evidences of the esteem which workers in entomology are gaining in the minds of men working in other branches of science. This news will be especially agreeable to the American entomologists who had the pleasure of meeting Doctor Marchal during his visit to the United States in the summer of 1913.

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